

Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

RESERVE
aTC424
.W4U5

WATERSHED WORK PLAN FOR MILL CREEK
WATERSHED, JACKSON AND ROANE COUNTIES,
WEST VIRGINIA

REPORT OF THE SOIL CONSERVATION SERVICE, DEPARTMENT
OF AGRICULTURE, IN ACCORDANCE WITH THE
PROVISIONS OF PUBLIC LAW 83-566

aTC4
.W4U5

✓
COMMITTEE ON PUBLIC WORKS
UNITED STATES SENATE

APRIL 1971

SERIAL NO. 92-17



Printed for the use of the Committee on Public Works

U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON : 1971

COMMITTEE ON PUBLIC WORKS

JENNINGS RANDOLPH, West Virginia, *Chairman*

EDMUND S. MUSKIE, Maine
B. EVERETT JORDAN, North Carolina
BIRCH BAYH, Indiana
JOSEPH M. MONTOYA, New Mexico
THOMAS F. EAGLETON, Missouri
MIKE GRAVEL, Alaska
JOHN V. TUNNEY, California
LLOYD BENTSEN, Texas

JOHN SHERMAN COOPER, Kentucky
J. CALEB BOGGS, Delaware
HOWARD H. BAKER, JR., Tennessee
ROBERT J. DOLE, Kansas
J. GLENN BEALL, JR., Maryland
JAMES BUCKLEY, New York
LOWELL P. WEICKER, JR., Connecticut

RICHARD B. ROYCE, *Chief Clerk and Staff Director*

J. B. HUYETT, JR., *Assistant Chief Clerk and Assistant Staff Director*

BARRY MEYER, *Counsel*

BAILEY GUARD, *Minority Staff Director*

TOM C. JORLING, *Minority Counsel*

Professional Staff Members: JOSEPH F. VAN VLADRICKEN, LEON G. BILLINGS, RICHARD D. GRUNDY, JOHN YAGO, HAROLD H. BRAYMAN, RICHARD W. WILSON, PHILIP T. CUMMINGS, JUDY PARENTE, AND RICHARD HEROD

AD-33 Bookplate
(1-63)

NATIONAL

A
G
R
I
C
U
L
T
U
R
A
L



LIBRARY

334601

aTC424
.W4U5

RESERVE

PRELIMINARY CONTENTS

	Page
Letter of submittal.....	v
Environmental statement.....	vii
Comments:	
West Virginia, State of.....	xi
Army, Department of.....	xii
Interior, Department of.....	xiii
Bureau of Sport Fisheries, report of.....	xvi
Health, Education, and Welfare, Department of.....	xviii
Agriculture, Department of.....	xix
Appalachian Regional Commission.....	xx
General table of contents.....	xxiii

U S DEPT. OF AGRICULTURE
NATIONAL AGRICULTURAL LIBRARY

OCT 20 1971

CATALOGING - PREP.

LETTER OF SUBMITTAL

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

April 15, 1971

Honorable Spiro T. Agnew
President of the Senate
Washington, D. C. 20510

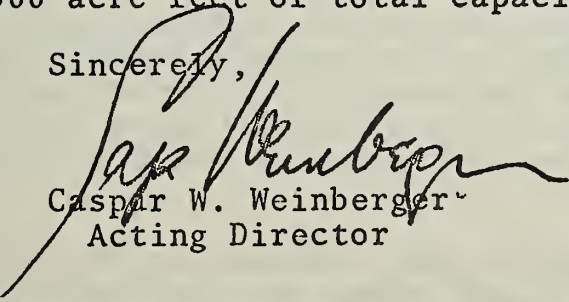
Dear Mr. President:

Pursuant to the authority vested in the President by section 5 of the Watershed Protection and Flood Prevention Act, as amended (16 U.S.C. 1005), and delegated to the Director of the Office of Management and Budget by Executive Order No. 10654 of January 20, 1956, there are transmitted herewith the following plans for works of improvement which have been prepared under the provisions of that Act:

<u>State</u>	<u>Watershed</u>
Georgia	Cedar Creek*
Illinois	Lower McKee Creek*
Illinois	Upper McKee Creek*
Kansas	West Sector Whitewater River*
North Dakota	Middle South Branch Forest River (Supplemental)*
Oklahoma	Deep Red Run-Coffin Creek*
Tennessee	Little Bigby Creek*
West Virginia	Mill Creek

Each of the above listed plans involves at least one structure which provides more than 4,000 acre-feet of total capacity.

Sincerely,


Caspar W. Weinberger
Acting Director

Note: Referred to the Committee on Public Works by the Secretary of the Senate on April 19, 1971, Executive Communication No. 32.

*Printed separately.

ENVIRONMENTAL STATEMENT

MILL CREEK WATERSHED, WEST VIRGINIA

Nature of Report or Action

The Mill Creek Watershed is located in Jackson and Roane Counties, West Virginia. The plan is proposed for Federal assistance under authority of the Watershed Protection and Flood Prevention Act, Public Law 83-566. Sponsoring local organizations are: Jackson County Court; City of Ripley; Western Soil Conservation District; Little Kanawha Soil Conservation District; and the West Virginia Department of Natural Resources.

The major agricultural enterprise in the watershed is production of live-stock and livestock products. Some of the more important crops grown in the area are: corn for grain and silage, and hay. There are about 450 farms, averaging 155 acres within the watershed area. More than 58 percent of the watershed is in forest cover, with grassland occupying about 32 percent. Two percent of the area is used for crop production and the remainder is in miscellaneous uses. Almost one-half of the needed conservation measures have been installed on 193 farms.

Floodwaters have harassed the City of Ripley since its establishment in 1832. Records indicate that major damaging floods have occurred about six times since 1910. Floods of lesser magnitude occur frequently. In addition, to the 376 properties, including 196 homes and 31 businesses, about 1,500 acres of cropland and pasture are subject to flood damage. Erosion and the resultant sediment damage in the flood-prone areas is low to moderate. Sediment deposits in urban areas are co-mingled with floodwater damage and constitute a significant part of the overall damage.

There are few public, water-based recreation developments within a 30-mile radius of the watershed. The projected population is expected to increase to more than 785,000 by 1980, an increase of about 13 percent.

Municipal water supplies for the City of Ripley are adequate and of good quality for the present population. The projected population increases indicate the water supplies will soon be inadequate for the needs.

Fishing is largely limited to Mill Creek, Elk Fork, and Tug Fork and is of low to moderate value. Fluctuating stream flows and sediment content are considered to be the main limiting factors in fish production, and detract to some extent from the fishing potential. Lake areas are needed to increase the amount of water that can be used to produce fish and provide habitat for water fowl.

Hunting areas are limited to farms in private ownership. Many of these areas are presently posted and not accessible to the general public. Hunting is limited to small game because of habitat conditions. Habitat suited to larger species, such as deer, is steadily improving.

The proposed project consists of accelerated conservation land treatment supplemented by five floodwater retarding structures and two multiple-purpose floodwater retarding structures, one with storage capacity for recreation and municipal and industrial water and the other with recreation water. Basic recreation facilities will be developed at each of the multiple-purpose structures.

I. Impact of the Proposed Action on the Environment

Accelerated land treatment measures are planned for 20,975 acres. In addition, 140 acres of critically eroding areas are to be stabilized. These measures will reduce runoff and erosion, increase the vegetative cover and improve the scenic quality of the landscape.

Opportunities for recreation will be created at the two multiple-purpose structures. Both structures are planned around 200-acre warm water lakes --- one for day-use activities (picnicking, fishing, boating) and the other with basic facilities for both day and overnight use. Recreation developments at the two structures are considered to be complementary and will receive an estimated 408,500 visits annually. Structure No. 13 also has 1,061 acre-feet of water supply for 3,000 additional users in Ripley. Sediment pools of the five single-purpose structures will have potential for recreation around 84 acres of water surface until they fill with sediment. Sanitary facilities, in accordance with state laws will be provided at those sites that are used for recreation.

The structural measures will provide a 100-year level of flood protection to 463 acres of agricultural land and 200 acres of urban area in the City of Ripley.

Land treatment and structural measures will improve the quality of water downstream by reducing the amount of sediment transported. This will be beneficial to fish and wildlife and improve the recreational and aesthetic values of the stream.

Sediment pools of the five floodwater retarding structures will increase the opportunity for fishery resources until they are gradually filled with sediment. The pools at sites 10 and 13 are expected to be productive warm-water fisheries.

The project is expected to increase and improve the wildlife habitat through controlled grazing and reforestation. It is expected that water management measures applied to the headwater region will benefit the downstream fishery resource by lessening sediment transport and reducing high flows.

II. Adverse Environmental Effects

The structural measures will eliminate approximately 14 miles of low quality stream fishery and 550 acres of wildlife habitat. Through consultation with Dr. Dallas B. Shaffer, University of West Virginia, it has been determined there will be no known archeological or historical sites that will be affected by construction in this watershed.

III. Alternatives to the Proposed Action

One alternative to the proposed action could be one of no project. This would permit continued flooding and the degradation of other natural resources in the watershed. It is estimated that net monetary benefits foregone by not implementing the project would be about \$600,000 each year.

Stream channel improvement was eliminated from consideration due to limited benefits, high costs, and adverse effects on fish and wildlife resources.

IV. Relationship Between Local Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

Long range uses of land and water resources as defined by the comprehensive plan for the area were considered in formulation of the project. Water supply storage is included for future growth of Ripley and vicinity. Maximum use will be made of the structural measures to satisfy the recreational need of the area. Structure sites were located to cause the least disturbance of residences and loss of high quality farmland and still provide the necessary flood protection. Land treatment measures are planned to conserve and maintain the productivity of the basic soil resource for future use by retarding runoff, reducing soil erosion, and using each acre of land within its capabilities and treating it according to needs.

V. Irreversible and Irretrievable Commitments of Resources

The present land use at structure locations would be changed, due to the installation of the structures and recreation areas. About 1,400 acres will be inundated by the pool areas, with 500 acres permanently covered with water/sediment in the sediment and multiple-use pools. No known mineable mineral resources exist under structure locations. These land use changes as a result of the installation of the project will result in a minor loss to the pasture and forest resource.

VI. The application for assistance under authority of the Watershed Protection and Flood Prevention Act was submitted to and approved by the state agency designated by the Governor of West Virginia. The plan for solving the land, water and related natural resource problems was developed in full consultation with Federal, state and local agencies and groups expressing interest. Numerous coordination meetings were held and contacts made during the development stage. Prior to preparation of the final plan, an informal field review was held in the watershed, at which time all interests were invited to present their views and recommendations, either orally or in writing. The plan and draft environmental statement were sent, formally, to designated state and Federal agencies for final review and recommendations.

This environmental statement has been prepared, giving consideration to such comments and recommendations as were provided by reviewing Federal agencies and the Governor of West Virginia.

The following comments, with a statement of the disposition made of each, were received on the Mill Creek project:

A. Consultation with Appropriate Federal Agencies

The Department of the Interior commented on the draft environmental statement. They noted an apparent error in the surface acres of lakes created by this project. They also commented on the possibility of archeological or historical sites of value being in the construction areas of the project. The lake surface area has been corrected in the final environmental statement. There are no known archeological or historical sites that will be affected. If any are found during construction the Department of the Interior will be notified.

B. Review by State and Local Agencies Developing and Enforcing Environmental Standards.

No problems or objections were noted by reviewing State and local agencies.

COMMENTS OF THE STATE OF WEST VIRGINIA



State Soil Conservation Committee
Charleston, West Virginia 25305

June 26, 1970

Mr. Kenneth E. Grant
Administrator
Soil Conservation Service
U. S. Department of Agriculture
Washington, D. C. 20250

Dear Mr. Grant:

This will acknowledge receipt of your letter of June 18, 1970 and the attached Work Plan for the Mill Creek Watershed, Jackson and Roane Counties, West Virginia.

The State Soil Conservation Committee has followed very carefully the progress of the Mill Creek Plan from the preliminary application to the completed final work plan. Progress on the Mill Creek project has been reported and reviewed very carefully at the meetings of the State Soil Conservation Committee, and the Committee has been represented at all public hearings.

In view of the above, it is the recommendation of the State Soil Conservation Committee that the Work Plan be accepted by your office and that the necessary steps be taken to get this project under way as quickly as possible. The Committee is of the opinion that this project has as great a potential as any that has been studied or proposed in the state to date. It has the full approval of the Committee.

Sincerely yours,

A handwritten signature in cursive script, reading "Gus R. Douglass".

Gus R. Douglass
Chairman

COMMENTS OF THE DEPARTMENT OF THE ARMY



DEPARTMENT OF THE ARMY
WASHINGTON, D.C. 20310

July 31, 1970

Honorable Thomas K. Cowden
Assistant Secretary of Agriculture
Washington, D. C. 20250

Dear Dr. Cowden:

In compliance with the provisions of Section 5 of Public Law 566, 83d Congress, the Administrator of the Soil Conservation Service, by letter of 18 June 1970, requested the views of the Secretary of the Army on the work plan for Mill Creek Watershed, Jackson and Roane Counties, West Virginia.

We have reviewed this work plan and foresee no conflict with any projects or current proposals of this Department. The draft of the environmental statement satisfies the requirements of Public Law 91-190, 91st Congress, insofar as this Department is concerned.

Sincerely,

A handwritten signature in cursive script that reads "Robert E. Jordan, III".

Robert E. Jordan, III
Special Assistant to the Secretary of the Army
(Civil Functions)

COMMENTS OF THE DEPARTMENT OF THE INTERIOR



United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

Dear Mr. Secretary:

July 29, 1970

This is in reply to the letter of June 18, 1970, from the Administrator of Soil Conservation Service, submitting for our review and comment the work plan for Mill Creek Watershed, West Virginia. In accordance with Section 2 of Executive Order 10913 and provisions of Section 5 of the Watershed Protection and Flood Prevention Act, as amended, this work plan has been reviewed by interested agencies of the Department of the Interior and the following comments are offered.

The Federal Water Quality Administration has recently completed a study in the Mill Creek Watershed to determine the need for reservoir storage for water quality control in the watershed. During this study, it was found that the community of Ripley and the Cedar Lake State Park provide secondary treatment while the small community of Cottageville has individual septic systems. The study concluded that the most feasible pollution abatement plan for the Mill Creek Watershed includes the combination of 95% BOD removal at Ripley plus about 1500 acre-feet of storage which would maintain a minimum of 5.7 cubic feet per second (cfs) in the stream at Ripley. It was recommended that Cottageville provide both a collection system for all sanitary wastes and a minimum of secondary treatment.

The proposed SCS work plan includes a multi-purpose reservoir on Tag Fork that would be used to supply future water supply needs at Ripley. The Federal Water Quality Administration's calculations indicate that an additional 1500 acre-feet of storage would be required to meet the water quality objectives in Mill Creek under the projected economic growth.

We recommend, therefore, that consideration be given to the inclusion of an additional 1500 acre-feet of storage to maintain a minimum of 5.7 cfs in the stream at Ripley and thereby meet water quality standards which have been established by the State of West Virginia for Mill Creek and its tributaries.

We are pleased that the subject work plan includes provisions for the collection and proper treatment of sanitary wastes at the proposed recreation facilities. We recommend that the final plans for these

waste treatment facilities be approved by the West Virginia Department of Health and that provisions be made in the operations agreement whereby all waste treatment facilities are properly operated and maintained during the recreation season.

Experience has shown that the physical and chemical characteristics of water vary in many reservoirs that have depths of 50 feet or greater of permanent storage. During periods of thermal stratification, which normally occur during the summer months, the bottom layers of the reservoir may contain water low in dissolved oxygen, high in iron and manganese content, and of objectionable taste and odor. In order to insure that downstream water quality is not adversely affected by release of poor quality water, it is recommended that all reservoirs in this project with depths of 50 feet or greater of permanent storage be provided with multi-level outlet structures capable of providing for adequate water quality control and facilities for monitoring such release.

It is also recommended, to protect water quality during the construction period, that the contract specifications require all contractors to adhere to guidelines for minimizing soil erosion and water and air pollution during construction as set forth in Soil Conservation Service "Engineering Memorandum-66".

We are pleased to note the consideration given to fish and wildlife resources during development of this work plan. Installation and operation of the project, as planned, will enhance fish and wildlife resources to meet the ever increasing demands for recreational activity related to these resources. It is requested that the enclosed report of the Bureau of Sport Fisheries and Wildlife accompany the work plan when it is forwarded to the Congress.

We note the Environment Statement indicates that structural measures will create 384 acres of high quality water surface. We question if this figure should not be 484 acres inasmuch as site 10 would provide 200 acres; site 13, 200 acres; and sites 4, 5, 6, 8, and 9 would total 84 acres.

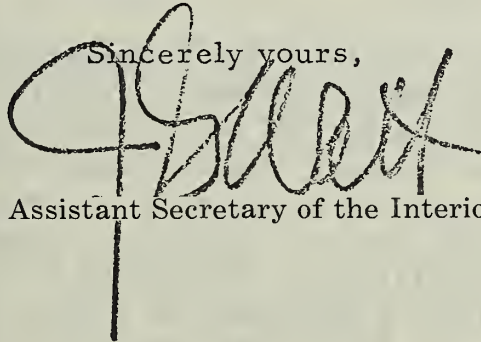
The paragraphs on Environmental Impact and Adverse Environmental Effects should reflect consideration of possible archeological, historical, and natural science values in the project area, and the actions planned or taken to identify and preserve or salvage such values. By letter of

March 21, 1968, the National Park Service advised that archeological, historical, and natural science values may exist in the project area and suggested that the University of West Virginia's Geological Survey be contacted to determine the existence and extent of these values. In addition, it was recommended that Dr. Dallas B. Shaffer, now located at University of West Virginia, be consulted concerning the program of the Historic Preservation Act of 1966 (P. L. 89-665).

The Chief, Southeast Archeological Center, National Park Service, U. S. Department of the Interior, P. O. Box 4547, Macon, Georgia 31208, should be kept advised of the progress of the proposed plan so that archeological surveys and any necessary salvage required under the Federal Reservoir Salvage Act (P. L. 86-523) may be programmed and completed prior to project construction.

We appreciate the opportunity to review and comment on this watershed work plan, and provided that the above recommendations are considered, we have no objections to the proposed project.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "F. S. [unclear]", written over the typed name below. The signature is fluid and cursive.

Deputy Assistant Secretary of the Interior

Honorable Clifford M. Hardin
Secretary of Agriculture
Washington, D. C. 20250

Enclosure



UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. POST OFFICE AND COURTHOUSE
BOSTON, MASSACHUSETTS 02109

August 30, 1967

Mr. Thomas B. Evans
State Conservationist
U. S. Soil Conservation Service
State Office
209 Prairie Avenue
Morgantown, West Virginia 26505

Dear Mr. Evans:

This letter constitutes our reconnaissance report on the Mill Creek Small Watershed in Jackson and Roane Counties, West Virginia. The project is sponsored by the Western Soil Conservation District, Little Kanawha Soil Conservation District, Jackson County Court, and the city of Ripley. It is being planned by authority of the Watershed Protection and Flood Prevention Act (68 Stat. 666), as amended. This report has been prepared under the provisions of Section 12 of that Act, and in cooperation with the West Virginia Department of Natural Resources and has its concurrence as indicated by letter dated August 23, 1967.

Mill Creek Watershed is 15 miles long and averages 14 miles wide. It consists of approximately 123,250 acres. Mill Creek flows through the city of Ripley in a northwesterly direction until it empties into the Ohio River at Millwood, West Virginia. The topography of the eastern part of the watershed is characterized by steep slopes, narrow divides, and narrow flood plains. Farther downstream the flood plains widen and the topography becomes more gentle. Elevations in the watershed range from about 570 to 1,100 feet above mean sea level. Most of the land is covered by forest.

The plan of development includes seven water retarding structures together with land treatment measures designed to reduce flooding and soil erosion and to provide water storage for municipal water supply and recreational use. Only one of the water retarding structures is presently planned for recreational use; of the remaining six, one will be for municipal water supply and the others for flood control only. Site number 13 will have a recreation pool of 200 acres.

The fishery resources of Mill Creek have declined in recent decades as a result of detrimental land use practices. The streams have been subjected to siltation and are characterized by irregular flows. Mill Creek receives fairly heavy fishing pressure during late spring and early summer, particularly in the lower portion downstream from Ripley. Principal fish harvested include muskellunge, spotted bass, crappies, other sunfishes and catfishes. Muskellunge are restricted to the areas downstream from Ripley due to the barrier effect from a low head dam at Ripley.

Principal wildlife resources harvested include deer, squirrel, cottontail rabbits and bobwhite quail. A few waterfowl occur during migration periods. Habitat conditions favor small game.

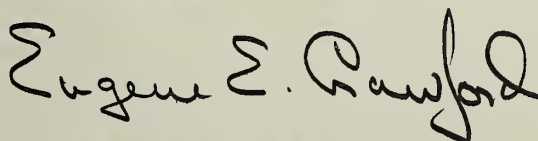
The impoundments will have no significant adverse effects on the present fisheries, while opportunity for increasing these resources at sites number 4, 5, 6, 8, 9 and 10 are negligible. It is to be expected that water management measures applied to the headwater region will benefit the downstream fishery by lessening siltation and reducing high flow velocities.

As presently envisioned the project will result in minor improvement of the wildlife resources. Land treatment measures that restore food and cover through controlled grazing and reforestation will measurably improve wildlife habitat. In reforestation special care should be taken to select plants having high value for wildlife foods and cover in order to realize the full benefits from these measures.

A productive warmwater fishery could be established at the recreational impoundment site number 13. In order to gain maximum fishery benefits from the planned recreational impoundment public access together with adequate parking facilities and a boat launching ramp should be provided. In addition, construction plans should include water level control structures which would permit complete drawdown of the impoundment to facilitate fishery management. This would be required to maintain high levels of fishery productivity.

In view of the active coordination which exists between your agency, the local sponsors, and the West Virginia Department of Natural Resources, whereby the fish and wildlife resource development possibilities will be thoroughly explored in the event that planning assistance is authorized, no further studies by this Bureau are considered necessary. In the event that you change your overall approach to the problems of the watershed, we would like to be advised in sufficient time to permit further consideration.

Sincerely yours,

A handwritten signature in cursive script that reads "Eugene E. Crawford". The signature is written in dark ink and is positioned centrally below the typed name.

Acting Regional Director

COMMENTS OF THE DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE



DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20201

October 6, 1970

Mr. Kenneth E. Grant
Administrator
U.S. Soil Conservation Service
Department of Agriculture
Washington, D.C. 20250

Dear Mr. Grant:

As requested in your letter of June 18, 1970, the Watershed Work Plan and environmental statement on Mill Creek Watershed, West Virginia, has been reviewed by the appropriate environmental health agencies of the Public Health Service.

Our review indicates that the Project as proposed by your agency will have no significant adverse effect on environmental considerations of concern to the Department of Health, Education, and Welfare.

Sincerely yours,

A handwritten signature in cursive script that reads "WR Strelow, for".

Roger O. Egeberg, M.D.
Assistant Secretary
for Health and Scientific Affairs

COMMENTS OF THE DEPARTMENT OF AGRICULTURE

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Washington, D. C. 20250

August 20, 1970

Honorable James G. Watt
Deputy Assistant Secretary
Department of the Interior

Dear Mr. Watt:

We appreciate receiving comments of the Department of the Interior contained in your letter of July 29 on the work plan for Mill Creek Watershed, West Virginia. We have noted your comments concerning water quality in Mill Creek at Ripley.

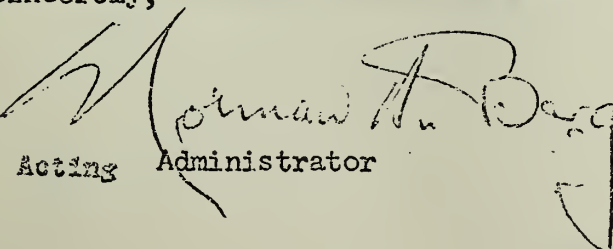
The proposal for adding storage capacity to the reservoir on Tag Fork, to maintain flows for water quality control, was given consideration during the development of the plan. Even though the need for maintaining the flow was recognized, the local sponsoring organizations did not have the funds available to defray the costs that would be necessary to add the storage capacity. If funds become available before the structure is constructed, we will encourage the sponsors to supplement the work plan to add the capacity for water quality control.

Your recommendation that multi-level outlet structures be installed on reservoirs with permanent storage exceeding 50 feet in depth is not applicable to this work plan. The deepest water at any of the planned reservoirs is 18 feet at structure site number 13.

As you point out, the water surface areas to be created by the project total 484 acres rather than 384 acres. The final Environmental Statement will include this correction. Reference will also be made to consideration of possible archeological, historical and natural science values.

Thank you for calling these matters to our attention and for the opportunity to provide this explanation.

Sincerely,


Acting Administrator

COMMENTS OF THE APPALACHIAN REGIONAL COMMISSION

THE APPALACHIAN REGIONAL COMMISSION

1666 CONNECTICUT AVENUE
WASHINGTON, D.C. 20235

OFFICE OF
FEDERAL COCHAIRMAN

August 10, 1970

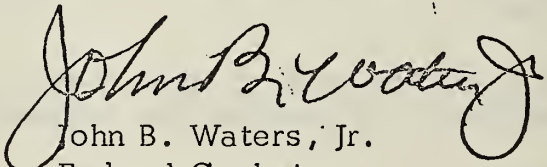
Mr. Kenneth E. Grant
Administrator, Soil Conservation
Service
Department of Agriculture
Washington, D. C. 20250

Dear Mr. Grant:

The Work Plan for the Mill Creek Watershed located in Jackson and Roane Counties, West Virginia, has been reviewed by the Commission staff. We find nothing in the plan inconsistent with other Appalachian investments. Adequate water supply and flood control should enhance the area's development potential. The significant recreation development in itself should have noteworthy economic effects, and indeed the scale of recreation development should play a major role in meeting urban as well as rural needs.

Review indicates a realistic appraisal of the environmental impact of this small watershed project. Development alternatives suggest the optimization of least environment disturbance, minimum cost, and maximum benefit.

Sincerely,


John B. Waters, Jr.
Federal Cochairman

WATERSHED WORK PLAN
MILL CREEK WATERSHED
JACKSON AND ROANE COUNTIES, WEST VIRGINIA

2001
WATERSHED WORK PLAN

MILL CREEK WATERSHED

Jackson and Roane Counties, West Virginia

Prepared Under the Authority of the Watershed
Protection and Flood Prevention Act (Public
Law 566, 83d Congress, 68 Stat. 666); as amended

Prepared by: City of Ripley

County Court of Jackson County

Western Soil Conservation District

Little Kanawha Soil Conservation District

West Virginia Department of Natural Resources

With assistance by:

U.S. Department of Agriculture, Soil Conservation Service

U.S. Department of Agriculture, Forest Service

September 1969

TABLE OF CONTENTS

	<u>Page</u>
SUMMARY OF PLAN	1
DESCRIPTION OF THE WATERSHED	2
Physical Data	
Economic Data	
Land Treatment Data	
Fish and Wildlife Resource Data	
WATERSHED PROBLEMS	7
Floodwater Damage	
Sediment Damage	
Erosion Damage	
Problems Relating to Water Management	
PROJECTS OF OTHER AGENCIES	12
PROJECT FORMULATION	12
WORKS OF IMPROVEMENT TO BE INSTALLED	14
Land Treatment Measures	
Structural Measures	
EXPLANATION OF INSTALLATION COSTS	22
EFFECTS OF WORKS OF IMPROVEMENT	26
PROJECT BENEFITS	28
COMPARISON OF BENEFITS AND COSTS	30
PROJECT INSTALLATION	30
FINANCING PROJECT INSTALLATION	33
PROVISIONS FOR OPERATION AND MAINTENANCE	35
TABLES	
Table 1 - Estimated Project Installation Cost	
Table 1a - Status of Watershed Works of Improvement	
Table 2 - Estimated Structural Cost Distribution	
Table 2A - Cost Allocation and Cost Sharing Summary	
Table 2B - Recreation Facilities - Estimated Construction Costs	
Table 3 - Structure Data	
Table 4 - Annual Cost	
Table 5 - Estimated Average Annual Flood Damage Reduction Benefits	
Table 6 - Comparison of Benefits and Costs for Structural Measures	
INVESTIGATIONS AND ANALYSIS	49
URBAN FLOOD PLAIN MAP	
RECREATIONAL DEVELOPMENT MAP	
PROJECT MAP	

WATERSHED WORK PLAN

MILL CREEK WATERSHED

Jackson and Roane Counties, West Virginia

September 1969

SUMMARY OF PLAN

Mill Creek Watershed is located in Jackson and Roane Counties, West Virginia, approximately 38 miles north of Charleston. Included in the watershed area of 123,250 acres is the city of Ripley.

Sponsoring local organizations for the project are the Jackson County Court, City of Ripley, Western Soil Conservation District, Little Kanawha Soil Conservation District, and the West Virginia Department of Natural Resources.

Frequent flooding and sediment damage to residences, businesses, roads, gardens, bridges, and utilities primarily in the Ripley area is the major problem in the watershed. Other problems are (1) floodwater and sediment damage to agricultural lands and improvements, (2) erosion of critical areas (roadbanks and urban developments), (3) lack of water-based recreation, (4) lack of an adequate water supply for the city of Ripley, and (5) declining fishery resources.

The works of improvement planned for this watershed are the most economical combination of land treatment and structural measures. Land treatment measures will be vegetative practices that will reduce runoff and improve soil, water, and wildlife resources of the watershed. Structural measures proposed in this plan will provide protection from floodwaters and will offer water-based recreation and water supply for the residents of Ripley and the surrounding area.

Total estimated installation cost of the land treatment measures is \$362,100. Of this amount, \$116,300 will be provided from P.L. 566 funds, and \$245,800 will come from other sources (Table 1).

Structural measures will consist of five single-purpose floodwater retarding structures and two multiple-purpose structures. One multiple-purpose structure will include floodwater and recreation storage. The second multiple-purpose structure will include flood, recreation, and municipal water storage. Total estimated installation cost of the structural measures is \$5,420,400. Of this amount, P.L. 566 funds will pay \$3,825,800, while \$1,594,600 will come from other funds.

All works of improvement will be installed in a period of five years. Structural measures are to be installed during the second through the fifth year. Land treatment measures are to be installed throughout

the five-year installation period. Total cost of the project is estimated to be \$5,782,500, of which P.L. 566 funds will be \$3,942,100, and \$1,840,400 will be provided by other funds.

Land treatment measures will be installed, operated, and maintained by individual landowners under cooperative agreements with the Little Kanawha and Western Soil Conservation Districts. The Jackson County Court will operate and maintain the five single-purpose structures. They will also be responsible for the operation and maintenance of one multi-purpose structure (site No. 10). The other multi-purpose structure (site No. 13) will be operated and maintained by the Department of Natural Resources and the City of Ripley.

Estimated cost of operation and maintenance of the structural measures is \$63,800 annually. This amount includes \$1,000 annually for the five single-purpose flood retarding dams, \$15,700 annually for the recreation and flood storage structure (structure No. 10), and \$47,100 annually for the flood, recreation, and water supply storage structure (structure No. 13).

Installation of the planned works of improvement will alleviate major watershed problems and provide an acceptable level of protection from a 100-year frequency flood to both agricultural and urban areas of the flood plain. Average annual flood damage will be reduced by 96 percent. In the urban area of Ripley, average annual flood damage will be reduced by 97 percent. Two recreation developments will help satisfy the need for recreation in the watershed and surrounding area. Municipal water storage added to structure No. 13 will provide an adequate water supply for the residents of Ripley. An adequate water supply will remove one basic constraint to development and economic growth.

Estimated average annual benefits resulting from installation of structural measures will be \$935,400. Average annual cost of installing, operating, and maintaining these measures is \$330,300, resulting in a benefit-cost ratio of 2.8:1.

DESCRIPTION OF THE WATERSHED

Physical Data

Mill Creek Watershed is located in west-central West Virginia in Jackson and Roane Counties. It has an area of 123,250 acres or approximately 192 square miles.

The city of Ripley with a population of 3,500 is the county seat of Jackson County and is the only incorporated city in the watershed. Ripley is located along north-south Interstate-77, midway between the industrialized cities of Parkersburg and Charleston, and is approximately 38 miles from each. U.S. Route 33 serves Ripley and surrounding areas in an east-west direction. It provides access to the Ohio River valley on the west and central West Virginia to the east.

Mill Creek is in the Appalachian Plateau Physiographic Province. It has a dendritic drainage pattern. Its headwaters drain part of southeastern Jackson County and western Roane County. Three main tributaries (Little Mill Creek, Elk Fork, and Tug Fork) join above the city of Ripley to form Mill Creek. Three miles west of Ripley, Parchment Creek, another major tributary enters Mill Creek. From this point it flows generally northwest and empties into the Ohio River at Millwood, West Virginia.

The topography of the eastern part of the watershed is characterized by steep slopes, narrow divides, and narrow, relatively flat flood plains. Proceeding downstream the flood plains widen and the topography becomes more gentle approaching the Ohio River. Total relief is about 550 feet. Elevations range from 580 to 1130 feet above sea level.

Surface rocks of the area are confined to the Dunkard Group of Permian age. The Dunkard Group in this area consists of siltstone and red clay-shale, interbedded with sandstones which sometimes are massive. The Hundred and Upper and Lower Marietta sandstones become quite massive in some locations and form prominent cliffs. There is a gentle regional dip of about 25 feet per mile northwest to the axis of the Parkersburg Syncline, which crosses Mill Creek three miles west of Ripley.

Principal mineral resources of the watershed are oil, natural gas, and salt brines. The Gay and Buffalo-Peniel oil fields have been in production since the early nineteen hundreds. Gas has been produced at several scattered locations across the area. Recent drilling to the Newburg sand of Silurian age is extending a very productive gas field from the Sissonville area northward into the watershed. This field shows potential for increased gas production.

Salt brines have not been developed in this area and there does not appear to be a market for them at this time.

Unlike most of West Virginia, there are no coals considered to be economically minable in Jackson County or in that portion of Roane County included in the watershed.

The Upshur-Muskingum-Vandalia association of soils are found in the uplands and footslopes and the Moshannon-Senecaville-Markland association on flood plains and terraces. Upshur soils are dominant. They are clayey, slowly permeable, have high shrink-swell characteristics, and are susceptible to severe erosion if not protected by good vegetative cover. They are the major source of sediment carried by the streams.

Ripley has the only public water supply system in the watershed at present. Water is taken from Mill Creek at a low dam in the city of Ripley at an average daily pumping rate of 270,000 gallons. Treatment consists of coagulation, sedimentation, filtration, and sterilization, which meets state health requirements for water quality. Rural dwellers depend on wells, springs, and cisterns for domestic use.

The climate is moderate with few extremes in either summer or winter temperatures. There is a January average of 36° and a July average of 75°. Average annual rainfall at Ripley is 40 inches. The average growing season is 164 days and extends from about April 30 to October 11.

Approximately 58 percent (70,838 acres) of the watershed area is in forest cover. Other land use is as follows: cropland, 2 percent; grassland, 32 percent; idle, 6 percent; and miscellaneous, 2 percent. It has been determined that 63 percent of the forest land is in poor hydrologic condition, 30 percent in fair, and 7 percent in good condition. With protection and intensified management, most of the forest land should be in fair to good condition by the end of the evaluation period.

The locations of the two potential recreation developments have above average aesthetic qualities. They possess a great variety of vegetative conditions from many spring wild flowers to rolling pastures and timberland. Steep rock bluffs at the water's edge are present at one development site. Both have scenic overlooks above the lakes that add to making this project one of very high quality.

Major urban centers expected to contribute clientele are Charleston, Huntington, and Parkersburg, West Virginia, and Athens and Marietta, Ohio. These are all within a 50-mile radius. The radius of drawing power will be expanded because of excellent access by way of Interstate 77 and U.S. Route 33.

Economic Data

The major agricultural enterprise in Jackson County is production of livestock and livestock products. In 1964 sales from this source amounted to 85 percent of the value of all agricultural products. Other significant products and their estimated acreage yields include corn harvested for grain, 75 bushels; corn cut for silage, 15 tons; hay, 3 tons; and pasture, 100 cow/acre days.

In 1964 the average farm size was 155 acres. The watershed was estimated to contain 450 farms with 35 full-time farmers averaging \$2,000 in net annual income per farm. The other 415 farms are part-time enterprises. Parts of 97 separate farm units are within the flood plain.

The value of bottom land for crops averages \$500 per acre. Upland areas range in price from \$50 to \$200 per acre. Median value of Jackson County owner-occupied housing units, up-dated to current values, is \$14,700. Undeveloped, one-fourth acre, urban lots in the flood plain are worth about \$200 under present conditions.

Present population of Jackson County is estimated at 23,000. Twenty-one percent is rural and 79 percent urban. Population of the watershed is estimated at 7,000, with 2,000 living in the flood plain.

Land use in the 1,885-acre flood plain, which includes 376 acres below the confluence of Parchment Creek, is comprised of approximately 65 percent

hay, 16 percent corn, 12 percent pasture, and 7 percent idle or other. All land is in private or institutional ownership except the 376 acre Cedar Lakes State Camp and Conference Center. This educational center is operated by the State Board of Education and consists of facilities for special groups or organizations. Public use on an individual or family basis is not permitted.

Forest land is 80 percent in hardwood forest cover, 13 percent in mixed hardwood-softwood stands, and 7 percent in softwood stands. Principal forest types are oak-hickory, mixed hardwoods, oak-Virginia pine and Virginia pine. There are several small white pine and Virginia pine plantations scattered throughout the area. About 20 percent of the forest stands are of sawtimber size, 63 percent are pole size, and 17 percent are seedling and sapling size.

Local markets are satisfactory for veneer logs and fair for sawlogs, pallet material, and pulpwood. Markets for most small forest products are generally limited.

All of the forest land is privately owned. There are two forest industry ownerships within the watershed, consisting of 6,000 acres and 200 acres. Most of the area is in farm ownerships, with an average sized forest acreage of about 130 to 140 acres.

Adequate forest fire protection is provided by the West Virginia Department of Natural Resources in cooperation with the U.S. Forest Service through the Clarke-McNary Cooperative Forest Fire Control Program.

Other current Federal-State Cooperative Forestry Programs include Cooperative Forest Management, Cooperative Forestation, and Cooperative Insect and Disease Control. Given protection, care, and management, the forests stands are expected to increase their contribution to the economy of the watershed community.

Jackson County had a total of 860 miles of roads in 1965. A network of primary, secondary, and feeder roads adequately serve the watershed area.

The watershed is located in the eight-county State Planning Sub-region 16 and is associated with primary growth centers of Charleston and Parkersburg. Unemployment in the sub-region, while dropping from 8.3 percent of the labor force in 1962 to 6.0 percent in 1965 is over 70 percent greater than the national average. From 1950 to 1960, overall employment in the sub-region increased 1 percent, while employment in agriculture and mining decreased 69 percent and 27 percent respectively.

Recent economic reports show that the employment trend in Jackson County is toward business services, wholesale and retail trade, and manufacturing. The following tabulation indicates actual and projected employment by industry, labor force, and population, 1960 to 2020:

<u>Industry</u>	<u>1960</u>	<u>1980</u>	<u>2000</u>	<u>2020</u>
Agriculture, Forestry, Fisheries	584	300	200	100
Mining	34	100	200	200
Construction	617	700	900	1300
Manufacturing	1833	2200	3000	4300
Transportation, Communi- cation, Utilities	284	400	600	900
Wholesale and Retail Trade	736	1600	2800	4400
Finance, Insurance, Real Estate	115	300	600	1000
Personal and Business Services	760	1700	3000	4900
Government	161	400	800	1300
Total	5124	7700	12100	18400
Labor Force	5602	8300	12800	19200
Population	18541	25000	35000	48000

Source: Office of Business Economics, Department of Commerce; U.S. Army Corps of Engineers, Huntington District; Office of Appalachian Studies. (1969)

Jackson County, in cooperation with four other counties is in the process of developing an application for the creation of a Resource Conservation and Development area.

Land Treatment Data

Land use in the watershed is rapidly changing. Small family farms are being abandoned and reverting to woodland. The production of clean-tilled crops has decreased significantly during the last ten years. Land use conversion to woodland is expected to continue, especially on the slopes too steep for wheeled vehicles.

An active land treatment program is promoted by the Little Kanawha and Western Soil Conservation Districts. Of the approximate 450 farms in the watershed, 193 are district cooperators covering approximately 43 percent of the land area. Approximately 47 percent of the planned practices have been installed on these farms. The percent of land above each structure

site under cooperative agreement is as follows: site No. 4, 25 percent; No. 5, 39 percent; No. 6, 42 percent; No. 8, 34 percent; No. 9, 37 percent; No. 10, 62 percent; and No. 13, 52 percent.

The Agricultural Stabilization and Conservation Service is also presently promoting land treatment with special Appalachian funds.

Fish and Wildlife Resource Data

Fishery resources of the area are concentrated mainly in Mill Creek, Tug Fork, and Elk Fork drainages, which provide approximately 25 miles of fresh-water fishing. Mill Creek receives fairly heavy fishing pressure during late spring and early summer particularly in the area below Ripley. Fishing is restricted upstream due to a barrier effect of a low head dam for water supply at Ripley. Species present in these streams are spotted bass, crappies, catfish, sunfish, and suckers.

The present crop of fish is estimated at 220 pounds per acre. These streams have an annual use of approximately 2,000 user days. The average annual value of this resource is estimated to be \$1,000.

The quality of water is satisfactory for warm-water fish production. Low flows in late summer and fall and siltation from critical eroding areas are occurring to a limited extent.

Principal wildlife species found include the cottontail rabbit, bobwhite quail, and squirrels. The whitetail deer population is small at present. The wildlife habitat of principally woodlands with underbrush and overgrown pastures are most favorable to small game. A few waterfowl also occur during migration periods.

The value of wildlife resources are considerable and provide hunting opportunities for several thousand residents of the area.

WATERSHED PROBLEMS

Mill Creek is in the 13-state Appalachian region. It has a number of problems attributable to past and present misuses of soil, water, and plant resources. Land has been plowed and cultivated beyond its capacity. Pastures have been stocked beyond their carrying capacity without needed treatment. Woodlands have been mismanaged for timber production and in many cases have not been adequately protected from grazing by livestock.

Primary areas where proper land treatment is needed are roadbanks (especially Interstate 77), bare areas in permanent pasture land, and land around new housing developments. These areas contribute a considerable amount of sediment.



Residents of the city of Ripley experiencing extensive damages and inconveniences during the flood of March 1967. Flooding occurs annually in the community.

Floodwater Damage

Floodwaters have harassed Ripley since its establishment in 1832. High watermarks indicate serious flooding occurred in 1910, 1913, 1937, 1939, 1966, and 1967. Local records kept since 1948 show the following floods and damages for the watershed.

<u>Date of Flood</u>	<u>Estimated Damage</u>
July 1948	\$ 75,500
March 1961	2,000
February 1962	19,500
April 1962	20,000
March 1963	9,000
March 1963	10,000
August 1963	10,000
April 1964	4,000
March 1965	20,000
May 1966	72,000
March 1967	233,100

Value of property subject to flood hazard amounts to \$9,451,000. This includes land and improvements on the 1,885-acre flood plain which is calculated to be inundated at least once every 100 years. The flood plain is relatively flat and there are numerous bayou-type inlets, coves, and drainage ditches where backwater accumulates at flood stage.

The most significant flood in recent years occurred March 6, 1967. A flood of this magnitude was determined to have a 20-percent chance of occurrence in the main damage area of Ripley. This is a flood that could be repeated on the average of once every 5 years. At the present level of development, a recurrence of the 1967 (key flood) would cause an estimated damage of \$233,100.

Under present conditions, a 100-year frequency flood would reach 6.9 feet higher than the flood of March 1967. This is in the vicinity of U.S. Highway 33 bridge in the main part of the city. A flood of this magnitude would affect 376 properties reaching first floors or higher in 196 homes and 31 businesses. The average depth of floodwater above first floors would be 3.7 feet for homes and 2.8 feet for businesses. Approximately 1,500 acres of crop and pasture land would be inundated and parts or all of 97 farm units would receive damage. Approximately 8 miles of roads and 11 bridges would be seriously damaged. At the present level of development, the 100-year or one percent chance flood would cause damage estimated at \$1,282,600.

On an average annual basis, direct damage in the flood plain amounts to \$155,300. Broken down by type, the average annual amounts are as follows:

Crop and pasture	\$ 3,900
Other agriculture	13,700
Commercial	25,700
Residential	97,900
Road and Bridge	4,900
Utilities	700
Municipal	8,500

The average annual indirect damage was determined to be \$20,400.

Local sponsoring organizations recognized the problem of deteriorated land use in their June 1, 1966, request for assistance. Their application states that "land suitable for residential development has been damaged, reducing the value of this land and restricting the anticipated growth in the watershed. Industrial growth has been hampered as a result of flooding. For example, at this time, an industry wishes to settle within the corporate limits of Ripley. They require approximately 22,000 square feet of space for their operation. This plant would offer employment for 200 persons. Ripley has the site available now, but one of the major requirements for this building is flood prevention."

Sewage from Ripley is collected into a waste-stabilization pond where it is disposed of by bacterial action. This pond is subject to flooding as frequently as once every 5 years. The possibility of disease that can result from such inundation is of great concern to the local people.

Sediment Damage

Mill Creek remains muddy or milky much of the time because the sediment load is primarily suspended clays and silt eroded from red clayey soils. This suspended material increases filtration costs for municipal water supply and is detrimental to fish and wildlife. The turbidity impairs recreation use and detracts from the beauty of the stream.

Out-of-bank flows deposit thin layers or coatings of clay and silt on agricultural and residential lands. Natural levees are sometimes formed by fine sands causing an impairment of natural surface drainage.

Sediment damage occurs along with floodwater damage in urban areas. It is so co-mingled that a separate sediment damage survey was not made. Sediment damage is included with floodwater damages.

Erosion Damage

Soils in this area are subject to severe erosion when not protected by good vegetative cover. Many areas lack good cover and are not being used within their capabilities. Sheet and rill erosion, particularly from steep overgrazed pastures, unvegetated roadbanks, and housing developments, is the major source of sediment carried by the streams. Current trends in land use are from pasture and cropland to brush or forest. Overall vegetative cover conditions are gradually improving.

Stream channel and flood plain erosion are insignificant due to very flat stream gradients and low velocities. Streambank erosion occurs at various locations along these flat meandering streams but is not serious enough to require project-type action. Many landowners have installed minor channel improvement and bank protection measures.

Problems Relating to Water Management

Recreation: There are few public water-based recreation developments in this area. Two small lakes in Ohio, Veto Lake, a distance of 30 miles, and Forked Run, a distance of 20 miles, help meet some of the recreation needs. North Bend State Park, approximately 45 miles distant, provides some stream fishing. A private lake at Evans, 6 miles from Ripley, offers fishing on a fee basis. The Ohio River is not used extensively for recreation for several reasons. The shoreline is steep and not suited for beach development, public access is restricted, fish flesh is tainted by chemical pollutants, and river traffic is heavy. The Cedar Lakes FFA and FHA Camp and Conference Center is for organized groups and does not provide any public recreation.

In 1960 the census showed a population of 696,000 within a 50-mile radius. The projected population for 1980 is 13 percent higher to a level of 786,000.

The Jackson County Court and the Department of Natural Resources have recognized the recreation need and have agreed to sponsor recreation in structures No. 10 and 13 respectively.

Municipal and Industrial Water: At the present time, the city of Ripley distributes an approved quality of water to about 4,000 persons. The source of supply is from a small impoundment on Mill Creek, which during dry years cannot consistently meet the demand. An additional 1,800 water users are expected by the year 1990. Present monthly consumption amounts to 8,100,000 gallons. Consulting engineers have projected a requirement of 35.0 million gallons monthly by the year 1990 and have shown that the most economical source for additional water is from storage of Mill Creek runoff. The City of Ripley has recognized this problem and has agreed to place municipal storage in structure No. 13. Investigations of ground water for water supply have shown that it is not an economical or sufficient source.

Fish and Wildlife: Fishing is largely limited to Mill Creek, Elk Fork, and Tug Fork. The low dam for water supply at Ripley somewhat restricts the movement of fish upstream. The primary game fish above the low dam is spotted bass. Access to the stream is restricted by private ownership of the flood plain. Much of this land is presently posted and the trend appears to be in this direction. Fluctuating stream flows and siltation from critical eroding areas is considered to be a limited problem in fish production and detracts to some extent from the fishing potential. Fishing activity is sporadic and reaches a peak in early spring and summer months during periods of high flows and drops off in late fall months when flows become low. Because of this limited seasonal use and limited kinds

of fish, this fishery is considered to be of only moderate value. Lake areas are needed to increase the amount of water that can be used to produce fish and provide habitat for waterfowl.

Hunting areas are limited to farms in private ownership. Many of these areas are presently posted and not accessible to the general public. Hunting is mainly limited to small game since habitat conditions favor small game production; however, habitat suited to larger species such as deer is steadily improving.

PROJECTS OF OTHER AGENCIES

This watershed was investigated jointly by the Corps of Engineers and the sponsoring local organizations with the assistance of the Soil Conservation Service. It was mutually agreed by both agencies that the works of improvement proposed in this plan will be the most feasible solution to the watershed problems. To provide limited immediate flood protection, a clearing and snagging project is being considered by the Corps of Engineers under authority of Section 208 of the 1954 Flood Control Act. The clearing and snagging project would increase overall project benefits and would supplement measures in this plan.

The Racine Locks and Dam project on the Ohio River presently is under construction by the Corps of Engineers. The dam will increase the normal navigation pool level to an elevation of 560 feet but will have no effect on duration or height of flooding along Mill Creek. The effects of the Racine Locks and Dam project were considered in the development of this plan and coordinated with the U.S. Army Corps of Engineers. The works of improvement have been planned in such a manner that no adverse effects will result to either project.

Construction of Interstate 77 has been completed in the watershed. The State is presently performing some additional channel clearance work near the interstate to allow for more efficient flows. This work will further improve the beneficial effects of this project.

PROJECT FORMULATION

Watershed problems were studied by the sponsoring local organizations and concerned federal, state, and local agencies. Possible solutions to these problems that could be provided under authority of P.L. 566 were considered in project formulation.

The sponsoring local organizations and the Service agreed that a project would be formulated to meet the following objectives:

1. Soil and water conservation will be stressed throughout the project area during the installation period. Future land use adjustments will be made that will contribute to effective utilization of all land in the watershed. This will include both urban and agricultural land,

renovating old and establishing new conservation practices where needed, and improving the economic conditions of low income-producing areas.

2. Flood protection will be provided to business and residential sections of the city of Ripley and outlying areas. Protection will be provided to eliminate damage from floods similar to the key flood of 1967, which was a 5-year frequency. Depth of flooding will be controlled in such a manner that floodwater will not exceed first-floor elevations from a 100-year frequency flood.

3. Development of multiple-purpose recreational structures to provide for water-based recreation on a regional and state-wide basis as well as for local residents. Recreational activities should include swimming, fishing, picnicking, boating, hiking, and camping.

4. Provide additional storage in a multiple-purpose structure to be used for a municipal water supply for Ripley.

5. Roadbank stabilization measures will be established on un-vegetated and poorly vegetated roadbanks throughout the area.

6. Preservation and improvement of existing fish and game resources will be stressed when assisting landowners with land use adjustments and while coordinating the project with the West Virginia Department of Natural Resources and the U.S. Fish and Wildlife Service.

Twenty floodwater retarding structures and two multiple-purpose structures were analyzed as to their effect in meeting project objectives. After studying several alternate combinations of the above structures, it was determined that five single-purpose structures and two multiple-purpose structures would meet project objectives most economically. This system will provide the highest degree of protection that can be economically justified. An alternate system was analyzed to determine the need of a structure on Sycamore Branch. This analysis showed that this structure was not necessary. Other structures were dropped from the project due to high construction costs, poor storage characteristics, and poor hydrologic effect in the damage areas. Stream channel improvement was considered but found to be unnecessary and not justified for this project. Another alternate system to provide protection to the agricultural areas of Parchment Creek was studied. It was determined that the cost of protection for this area would exceed the benefits.

The seven structures proposed for this plan are sites No. 4, 5, 6, 8, 9, 10, and 13. Their locations are shown on the project map. Construction of these structures will reduce flooding in Ripley from the 100-year frequency flood to a level below first floors while also providing recreational and municipal water benefits. Sites No. 10 and 13 were determined to have the highest recreational potential. This determination was made with help from the West Virginia Department of Natural Resources after careful consideration of population distribution, use of natural and historic areas, soil types, quality and quantity of water, proximity and access to population centers, climate, natural scenic areas, and rural ownership. Water quality was analyzed by both the Department of Natural Resources and the West Virginia

State Health Department. These agencies agreed that water quality at sites No. 10 and 13 was sufficient for the type of recreation activities needed to meet the objectives of this plan.

To formulate the municipal water features of the plan, the city of Ripley obtained the services of the engineering consulting firm, Kelley, Gidley, Staub and Blair, of Charleston, West Virginia. After considering three alternate locations (sites No. 5, 10, and 13), the consulting firm determined that site No. 13 was the most favorable for municipal water storage. This selection was based on a comparison of available water yield, as compared to the municipal demand, location of the structure in relation to the treatment plant, water quality, and the ability of the site to hold water and costs of water storage. Water samples collected and analyzed by the West Virginia State Health Department indicated that with the present level of treatment water quality of the municipal water included in site No. 13 will be adequate for use by the city of Ripley.

The works of improvement proposed in this plan have been developed in accordance with the National Historical Preservation Act of 1966. There are no known archeological or historical sites which would be affected by structural measures.

This watershed work plan has been coordinated with the Jackson County Planning Commission and all works of improvement in this plan are being included in the county comprehensive plan now being prepared.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

To achieve adequate treatment of watershed lands to meet project objectives it will be necessary to apply treatment to 2,550 acres of open lands and 18,565 acres of forest land. This estimate is based on present needs and projections with respect to future land use. Applicable alternative treatments outlined in the Soil Conservation Service technical guides for the area were used. Soil surveys have been completed and the report published covering this watershed.

Open Land Treatment

Cropland Measures (150 acres) - This item has been grouped into two classes based upon the drainage condition of the soil. Alternative treatment outlined in the Soil Conservation Technical Guides for cropland with drainage problems includes such measures as cropping systems, tile drains, grassed waterways, and crop residue management. Practices outlined in the guide for well-drained cropland are conservation cropping systems, grassed waterways, crop residue management, and contour farming.

Grassland Measures (2,000 acres) - Practices consist of pasture and hayland management, pasture and hayland plantings, ponds, spring developments, troughs, and brush control.

Miscellaneous Land and Critical Areas (400 acres) - The primary practices on this land will consist of establishing vegetative

cover on the following critical areas: 40 acres of roadbanks, 30 acres of land around urban developments, and 70 acres of bare areas in pasture lands. The roadbank areas are primarily on Interstate 77 and are shown on the project map. Urban developments are located near the city of Ripley. Overgrazed pastures are scattered throughout the watershed but primarily below structure locations. Other practices planned are wildlife habitat preservation and ponds. These practices will have a great effect on the reduction of sediment damage in the watershed. They will also reduce runoff due to increased infiltration and vegetative cover.

Technical Assistance - Technical assistance available to the district under going programs will continue at the going rate. Additional technical assistance will be needed to accelerate land treatment measures. Basic resource plans will be prepared for approximately 35 landowners in the watershed. Resource plans will be revised for approximately 50 landowners. Individual landowners will be encouraged to practice conservation and use every acre of land within its capabilities. Maximum use will be made of the published soil survey report. Assistance will be provided landowners in planning, designing, and installing conservation practices.

Forest Land Treatment

Forest Land Measures (18,565 acres) - The following remedial program has been developed from a statement of land treatment needs prepared by the West Virginia Department of Natural Resources and the U.S. Forest Service. Land treatment needs were determined by a field survey of the watershed.

Tree Planting (1625 acres) - Reforestation of appropriate open land is necessary to adjust land use with capability and to reduce runoff and erosion by developing a protective cover and an absorbent forest floor of litter and humus.

Hydrologic Cultural Operations (1660 acres) - These silvicultural operations are aimed at improving hydrologic conditions by manipulation of stand composition to create conditions favorable for the maximum production and protection of litter, humus, and forest cover. They include thinnings, weedings, improvement and salvage and harvest cuttings.

Woodland Grazing Control (6.5 mile of fence - 4,120 acres) - The fencing out of domestic livestock prevents impairment of hydrologic condition in forest land by reducing soil compaction and damage to tree roots, seedlings, and other ground cover. Preventing this damage allows a litter and humus layer to build up to a desirable level providing optimum conditions for good infiltration and storage of water in the soil profile.

Skid Trail and Logging Road Erosion Control (4 miles - 160 acres) - This measure will reduce runoff, erosion and sedimentation by

diverting water from eroding skid trails and logging roads. Simple water bars (ditches with pole or earthen diversions) spaced at specified intervals are the usual means of controlling or diverting water. Stabilization is further attained by sowing forest grasses and shrub and tree planting.

Technical Assistance (11,000 acres) - Individual management plans will be prepared for approximately 110 forest landowners involving 11,000 acres, to provide proper installation and maintenance of approved measures. These plans outline practical measures to be applied in the immediate future to maintain and improve the hydrologic condition of their forest land. Technical assistance is needed for stimulation of landowner interest and participation, and for general planning, supervision, and inspection of the forestry program.

Structural Measures

Structural measures consist of five single-purpose floodwater retarding structures, one multiple-purpose structure for recreation and flood prevention, and one multiple-purpose structure for recreation, municipal water supply, and flood prevention.

Each structure will have a design life of 100 years and will control runoff resulting from storms up to the 100-year frequency.

This system of seven dams will control runoff from about 64,385 acres which amounts to 74 percent of the watershed area above Ripley. Total flood storage will amount to 19,584 acre feet. Sediment storage in the single-purpose structures will be approximately 445 acre feet and will provide 84 acres of water in the sediment pools. Total beneficial storage for sites 10 and 13 is estimated at 3,012 acre feet. One thousand nine hundred fifty-one acre feet of this storage will provide 350 acres of water surface for recreational use and the rest will be used to provide a dependable supply of water for Ripley.

The five single-purpose structures are Nos. 4, 5, 6, 8, and 9. Embankment will be of compacted earth fill with single-stage principal spillways. Principal spillways will be composed of a concrete drop spillway outletting through a reinforced concrete conduit. On sites No. 4 and No. 5 the principal spillway is planned to be on a yielding foundation due to the depth of alluvium above bedrock. On sites No. 6, 8, and 9 the principal spillway is planned to be placed on bedrock. The principal spillway will control runoff resulting from all storms up to the 100-year frequency. Additional flood storage was added below the emergency spillway crests when it would provide for a more adequate emergency spillway design. Emergency spillways will be excavated around the structures and designed to handle floods in excess of the 100-year frequency. Flow through the emergency spillway will be routed at non-erosive velocities. Emergency spillways will be excavated in material classified as soft-red shales and moderately hard sandstones. Embankment material will come from alluvial clays in the flood plain above the dams and shales excavated from the emergency spillways. The structures will function at 100 percent capacity.

during the design life with a decreasing capacity thereafter. Sediment storage is provided for the full design period; however, the initial sediment pool capacity will be the first 50-year submerged sediment accumulation.

Installation of the single-purpose structures will require relocation or modification of an estimated 26,000 linear feet of telephone lines, 26,400 linear feet of electric power lines, and 270 linear feet of a gas line on site No. 5. Easements or fee simple title will have to be obtained for approximately 42 buildings and 473 acres of land.

Site No. 10 is planned as a multiple-purpose flood prevention and recreation structure. Recreational features will include the development of 217 acres of land and a 200-acre lake. Embankment will be of compacted earth fill with a single-stage principal spillway. The principal spillway will be constructed on a yielding foundation and will consist of two 48-inch diameter reinforced concrete conduits outletting into a concrete impact basin. Inlet into the principal spillway will be through a reinforced concrete riser. Material for the earth embankment will come from the emergency spillway excavation and recreation pool. Recreation storage in the amount of 1,075 acre-feet has been included to provide the 200-acre recreation pool along with 620 acre-feet of sediment storage and 5,855 acre-feet of flood prevention storage. Drainage area of site No. 10 is 16,900 acres or 20 percent of the total watershed area above Ripley.

Installation of this structure will require fee simple purchase of an estimated 631 acres of land and 10 houses and buildings. In addition flooding easements will be necessary on 180 acres of land. Relocation or modification of approximately 14,400 linear feet of West Virginia local service highway 26, 14,200 linear feet of telephone lines, 13,100 linear feet of electric lines and one gas well will be required.

Site No. 13, which has a drainage area of 33,500 acres and will control 39 percent of the watershed area above Ripley, is planned as a multiple-purpose structure for flood prevention, recreation, and municipal water supply for the city of Ripley. Recreation storage of about 876 acre-feet has been added to this structure to provide a 150-acre lake along with 1,061 acre-feet of municipal water supply storage. The municipal water supply will increase the lake size to 200 acres and provide water supply by augmenting stream flow through Ripley during dry periods. In addition to the recreation and municipal water supply storage, approximately 889 acre-feet of sediment storage and 8,430 acre-feet of flood storage will be provided. This structure will be constructed of compacted earth fill with a concrete principal spillway. Placement of the principal spillway will be on a non-yielding foundation composed of hard sandstone. The principal spillway will be constructed of a reinforced concrete riser and two 54-inch diameter concrete conduits outletting into a concrete stilling basin. Materials for the embankment will be soft shales from the emergency spillway and clays from the flood plain above the dam. The upstream face of the dam will be protected from wave action with rock riprap throughout the range of municipal water drawdown. A 20-foot recreation access road has been planned across the top of the dam; however, it is not anticipated that additional fill will be necessary to accommodate this road.

Installation of structure No. 13 will require the purchase of approximately 1,186 acres of land and 15 houses and buildings. Flooding easement will be required on an additional 226 acres. Relocation or modification of about 680 linear feet of telephone lines, 5,720 linear feet of electric power lines, 17,800 linear feet of dirt roads, and 2,600 linear feet of gas lines will also be required. Raising of the West Virginia local service highway at Statts Mills, along with construction of a new bridge across Tug Fork has been coordinated with the West Virginia State Road Commission.

For more detailed structural data, see table 3 and the watershed map.

Basic Facilities

Recreation developments are planned at structures No. 10 and No. 13 and will be complementary in nature. Recreation activities will include camping, picnicking, swimming, fishing, water skiing, hiking, sight-seeing, and nature walks. Game areas will be available for horse shoes, volley ball, badminton, croquet, and softball. Water supply and sanitary facilities for these activities will be available at convenient locations. Both developments will incorporate special facilities for the physically handicapped.

Plans for the recreation complex at site No. 13 were developed by the West Virginia Department of Natural Resources. They have a reputation for good planning and efficient operation of recreation developments all over West Virginia. They presently operate 20 state parks, 9 state forests, and numerous fishing lakes and public hunting areas.

This area is planned to be used quite extensively for both day use and overnight use. Major developments will be located on the left side of the lake immediately above the dam on top of the hill. This is an area of gentle topography and covers about 150 acres. Access to this area will be controlled and traffic barriers and safety devices are planned to provide safety for park visitors.

There will be an 88-unit modern camping area located approximately 2,000 feet above the dam. Each unit will consist of a gravel spur, picnic table, fireplace, trash rack, and site improvement. Adjacent to this area will be a 30-unit overflow camping area for heavy use on holidays and weekends. Access to the rest of the recreation development can be gained by automobile or on foot. Two gravel parking lots 22 feet by 120 feet will serve the two comfort stations located within the camping areas. Water will be provided by six fountains conveniently located throughout the area. Sanitary facilities will be provided by two sanitary buildings, a 1400-gallon aerobic digester and disposal field, and two dump stations for self-contained trailers. Each sanitary building includes four flush-type toilets, three showers, and four lavatories for women and three flush-type toilets, three showers, two urinals, and four lavatories for men.

A 60-unit picnic area designed to accommodate 300 people at one time will be located adjacent to the camping area. Each unit will consist of an eight-foot table, fireplace, and trash rack. The picnic area will have six water fountains, one sanitary building divided for men and women, and a 2500-gallon aerobic digester and disposal field. The sanitary building includes four flush-type toilets and two lavatories for women and two flush-type toilets, two urinals, and two lavatories for men. There will be a 96-car asphalt parking lot conveniently located to serve the main picnic area.

A concentrated play area will be located between the camping and picnic areas. It will initially be developed with three asphalt paved game courts and two acres of graded and grassed area. There will be playground apparatus for children and a renovated log cabin shelter located in the game court area. A sanitary building will be located nearby and will be divided for men and women. It will include three flush-type toilets and two lavatories for women and one flush-type toilet, two urinals, and two lavatories for men. If demand for swimming facilities outgrows the beach area, an Olympic-size swimming pool will be installed. A bathhouse incorporating sanitary facilities and a 76-car paved parking lot will also be provided for pool users.

Swimming will initially be provided by a 61,000 square foot sand beach located adjacent to the camping and picnic areas. It will be accessible on foot or by automobile. There will be a 70-car asphalt paved parking lot. The beach area will consist of a bathhouse with open roof and incorporated sanitary facilities. There will be an entrance control booth and 1,785 feet of chain link fence to close the area. There will be a concrete patio at the waters' edge, sand beach, diving platform, three lifeguard stands, a 4' x 35' floating walk, two slides (one 30-foot and one 10-foot), and 900 linear feet of buoys and rope. Six lighting units on 20-foot poles will permit nighttime use. Ten trash racks will be provided. There will be a 20-unit picnic area near the beach. Each unit will consist of one grill, 8-foot table, and a trash rack. The old covered bridge at Statts Mills will be relocated to the beach area. It will cross a narrow ravine just above the access to the beach and will be used as part of the path to the access booth. It will provide a point of both scenic and historical interest and provide observers, photographers, and artists with a picturesque scene.

The main boat launch will be located on the right side of the lake about 500 feet above the dam and will be accessible by a road across the top of the dam. The boat launch area will have a 50' x 100' boat launch ramp, boat dock, and slots for 48 boats. Twenty-five rental boats will be available. Adequate parking space for 48 car-trailers and 57 cars will be provided by a 4,570 square yard paved parking lot located beside the boat launch area. A sanitary building consisting of six flush-type toilets and three lavatories for women and three flush-type toilets, three urinals, and three lavatories for men will be located in this area.

The tent and overflow camping area will be located just below the dam. Both the main boat launch area and the overflow camping area will be served by the same sewage treatment plant. The system will be the complete

treatment type and will be located below the dam. There will be a sanitary building divided for men and women to serve this area. The building will include four flush-type toilets, three showers, and four lavatories for women and three flush-type toilets, three showers, two urinals, and four lavatories for men.

One unique feature of this development will be a primitive camping and picnic area to be located along the left side of the lake about one mile above the dam. It will be accessible only by boat or on foot. There will be 15 camping units consisting of a table, fireplace, trash rack, and improved tent site. Adjacent to this area but secluded from it will be a boat-in primitive picnic area. There will be 20 units consisting only of a table, cook pit, and trash rack. Two boat docks will provide access to these areas. Visitors may also hike in to this area. A trail along the lake will lead from the overflow boat launch and parking area to the primitive camping area. Pit toilets will be used for sanitary facilities. Two wells and hand pumps will provide drinking water. There will be a gravel service road for cleanup and trash removal.

Boating on the lake will be zoned into two use areas. The area from the dam up to the bridge at Statts Mills will be primarily for pleasure boating and water skiing. Above Statts Mills the lake will be restricted to row boats for fishing and rowing for pleasure. Facilities in this area will include a boat launch, boat dock, and a fishing pier designed for the physically handicapped. A 3,780 square yard parking area to accommodate 30 cars and 50 car-trailers will be located near the boat launch. Pit toilets will be used in this area. Water will be provided by wells and hand pumps.

Nature trails will circle the camping, play, and picnic areas. There will be 7,800 linear feet of trails and five scenic overlooks with log and stone barriers for safety and beauty. Pit toilets will be located along the trails.

There will be 5.5 miles of fishermen's trails. These trails will make most of the shoreline below Statts Mills readily accessible on foot for fishermen wishing to fish from shore.

An existing residence along the access road will be used for the caretakers home. Two additional buildings will be constructed for storage and repair shops.

Water supply for the main camping and picnic area will come from wells and a 200,000-gallon water storage tank. The water system is estimated to cost \$27,744. This cost includes the cost of wells, storage tank, pumps, valves, distribution boxes, pipe, and trenches.

Electrical power will be supplied by buried power lines. This will preserve the beauty of the landscape and improve safety.

The map of the lake and public recreation development can be found in the back of the work plan. It shows the dam, recreation lake, existing

roads, and the locations of various recreation developments with respect to the lake. A location map shows the location of the site with respect to nearby urban areas.

Development of site No. 10 will be centered on day-use activities only. The recreation development will be made up of three separate use areas which will provide picnicking and play areas and access to the lake for fishing and boating.

Picnic area No. 1 is located just above the dam and emergency spillway on the right side of the lake. It will cover about five acres on a gently sloping ridgetop. A paved access road will enter the area from the relocated main road in back of the emergency spillway. There will be an entrance control gate and booth to regulate use of the area. This area is planned to accommodate 300 people at one time. Two picnic shelters with a fireplace, concrete floor, electricity, trash racks, and 10 tables will be provided for group picnicking. In addition to the shelters, there will be 20 picnic units. Each will consist of a charcoal grill on a concrete slab, two 8-foot picnic tables, and trash rack on a concrete slab with a post, lock and chain. Two gravel parking lots will provide parking for 75 cars. One centrally located sanitary facility will serve the entire area. It will be divided for men and women. The facility will include three flush-type toilets and two wash basins for women and two flush-type toilets, one urinal, and two wash basins for men. Sewage disposal will be by an extended aeration treatment plant. Six water fountains will be installed at convenient locations. An overlook above the emergency spillway will provide a scenic view of the dam and lake. A nature trail will run from this area to the lake and return. Six hundred forty feet of chain link fence will be installed at the emergency spillway to protect picnickers and others users from falling over the steep embankment.

Picnic area No. 2 will be located at the extreme upper end of the lake and will cover about 7 acres. This area will have a paved access road, control gate, and booth. There will be parking provided for sixty cars on two graveled parking lots. This area will accommodate 250 people at one time. There will be one large picnic shelter with fireplace, electricity, concrete floor, 10 tables, and trash racks. Twenty picnic units consisting of a charcoal grill on a concrete slab, two 8-foot tables, and a trash rack on a concrete slab with post, chain, and lock. An open playground area will be shaped and seeded to desirable grasses. Playground apparatus will be provided for children. One centrally located sanitary facility divided for men and women will serve the entire area. The facility will include three flush-type toilets and two wash basins for women and two flush-type toilets, one urinal, and two wash basins for men. Sewage disposal will be by an extended aeration treatment plant. Water will be provided by a well and storage tank. Five water fountains will be conveniently located. A footbridge will cross just above the lake and a trail will provide access for fishermen on foot to the left side of the lake. This trail can also be used for nature walks or walking for pleasure.

Picnic area No. 4 will be located between areas No. 1 and 2. It will be on the right side of the lake approximately 7,500 feet upstream from the dam. This area will be primarily a fisherman or boaters access point with facilities for picnicking or a combined picnic and fishing outing. Parking will be provided for 20 cars and trailers and 40 cars. There will be one large picnic shelter like those at areas 1 and 2. There will be ten picnic units each consisting of a charcoal grill, two tables, and trash rack. Water will be supplied by a well and storage tank. One centrally located sanitary facility divided for men and women will serve this area. The facility will include three flush-type toilets and two wash basins for women and two flush-type toilets, two wash basins, and one urinal for men. Sewage disposal will be by an extended aeration treatment plant. A projected fishing pier with guard rails will be constructed. There will be an 8' x 100' boat dock and a 16-foot wide boat launching ramp. This area will also have controlled access with a control gate and booth on a paved access road.

Foot trails will link the three areas and provide fishermen access to the lake. Additional area is available for expansion of the basic facilities when demand increases.

Plans for sanitary waste disposal and drinking water systems were coordinated with the West Virginia Public Health Department and meet their requirements and approval.

The recreation development map shows the dam, emergency spillway, recreation lake, existing roads, proposed locations and kinds of recreation developments, and proposed access roads. A location map shows the relative position of site No. 10 with respect to nearby population centers.

EXPLANATION OF INSTALLATION COSTS

Land Treatment

The costs for applying land treatment measures for the various practices shown in table 1 include the normal costs experienced in installation of such practices. These costs were developed by the State Program Staff of the Service and are based on current costs of farm labor, equipment, and materials.

Technical assistance for the planning and application of land treatment will be continued at the rate existing prior to completion of this plan. Acceleration is needed to establish the land treatment measures outlined on table 1 within the project installation period. Total cost of technical assistance to plan and apply land treatment measures on open land in the watershed is estimated to be \$72,500. The regular conservation program of the Service will provide \$25,300 for this assistance. Technical assistance for accelerating the planning and application of land treatment measures costing \$47,200 will be provided from P.L. 566 funds.

Application costs will be provided from P.L. 566 for furnishing materials to revegetate approximately 40 acres of critically eroding roadbanks. The remaining costs for equipment and labor will be borne by the Western Soil Conservation District.

Costs for installation of forest land treatment measures are based on current costs of supervision, labor, equipment and materials needed to install the various measures.

Costs of technical assistance for installation of forest land treatment measures are based on actual expenditures and accomplishments of the West Virginia Department of Natural Resources. An analysis of costs against accomplishments was made for each measure to determine unit costs for technical assistance. Acceleration is needed to accomplish the forest land treatment measures outlined in table 1 within the project installation period. Accomplishment of this accelerated program depends upon appropriation of funds for this purpose, and on additional personnel to work on this project. The current program of forest land treatment measures will continue at the present rate and will be financed by the Cooperative Forest Management Program. Technical assistance for the accelerated treatment will be provided from P.L. 566 funds.

Floodwater Retarding Structures

Construction costs of the five single-purpose floodwater retarding structures, amounting to \$1,218,000, and associated engineering and administrative cost will be borne by Public Law 566 funds. Total Public Law 566 cost for installation of these structures is \$1,548,700.

Land, easements, and rights-of-way, including relocations, for these structures will be furnished by local organizations. Estimated value of land easements, legal fees, changes in utilities, buildings, and roads and bridges is \$311,500, which includes the values of any easements that may be donated.

Cost computations for the single-purpose floodwater retarding structures were made at 1968 prices and based on calculated quantities. Unit prices were obtained from bid prices for work of a similar nature and adjusted for location, topography, and foundation conditions. A contingency allowance of 12 percent was added to the final estimate.

Multiple-Purpose Structures

The Use-of-Facilities Method was used to allocate joint construction and engineering services cost to purpose to be served for each multiple-purpose reservoir. Cost of the municipal water outlet was a specific cost assigned to municipal water supply. The following tabulations show allocation of storage to purpose for these structures:

Allocation by Purpose

Structure No.	Flood Prevention		Municipal Water		Recreation		Total	
	Ac. Ft.	Percent	Ac. Ft.	Percent	Ac. Ft.	Percent	Ac. Ft.	Percent
10	6,475	85.8	0	0	1,075	14.2	7,550	100
13	9,319	82.8	1,061	9.4	876	7.8	11,256	100

Land Rights Costs: Cost of all land rights was estimated to be \$1,213,600. The following is a breakdown of these costs:

Relocation or Modification of Existing Improvements:

Buildings	\$ 145,600
Roads	511,100
Utilities	<u>258,900</u>
Subtotal	\$915,600
Flowage Easements (879 Ac.)	100,600
Land Purchase (1,817 Ac.)	186,200
Legal Fees and Surveys	<u>11,200</u>
TOTAL	\$1,213,600

Land rights costs at multiple-purpose structure No. 10 were allocated by the areal method based on area of use. The cost of land purchased in fee-simple title, estimated at \$399,000 for 631 acres, was allocated to recreation. The cost of flowage easements on land above the taking line, estimated at \$19,100 for 180 acres, was allocated to flood prevention. The total cost of land rights at structure No. 10 is estimated to be \$418,100. Public Law 566 will bear \$199,200 of the cost.

In reference to multiple-purpose structure No. 13, which incorporates capacity for flood prevention, municipal water, and recreation, the land rights costs were allocated by the areal method based on area of use. Cost of land purchased in fee-simple title for recreation, estimated at \$438,200 for 1,111 acres, was allocated to recreation. Cost of land required for municipal water, estimated at \$47,300 for 75 acres, was allocated to municipal water. The cost of flowage easements above the taking line, estimated at \$8,500 for 226 acres, was allocated to flood prevention. The total of all land rights costs at structure No. 13 is estimated to be \$484,000 and P.L. 566 will bear \$206,400 of this cost.

Construction Costs: Construction costs of the two multiple-purpose structures is estimated to be \$1,218,700. These costs were computed in the same manner as the single-purpose structures.

The construction cost for multiple-purpose structure No. 10 on Elk Fork is estimated to be \$609,000. This cost includes \$60,000 for rock excavation in the emergency spillway, \$193,300 for placement and compaction of the earth embankment, \$31,300 for clearing and grubbing

of the construction area and recreation pool, \$131,900 for installing the principal spillway system, \$68,700 for construction of a positive cutoff, and \$30,600 for a system of seepage drains. The remaining cost of \$93,200 is for outlet channel, riprap, seeding, and other similar items.

The construction cost for the recreation basic facilities on structure No. 10 is estimated to be \$261,400. Items of construction include access roads, parking lots, boat docks, picnic shelters, sanitary facilities, safety devices, trails, fishing pier, game area, and so forth. (See table 2B for a complete listing of all planned facilities.) Unit costs for these items are based on bid prices for work of a similar nature and reflect the quality specified by Soil Conservation Service standards established for West Virginia. This cost will be cost-shared on a 50-50 percentage basis.

Construction cost of multiple-purpose structure No. 13 is estimated to be \$611,700. Items of construction include emergency spillway rock excavation, \$56,500; earth embankment, \$135,900; placement of the principal spillway system, \$174,500; clearing and grubbing, \$65,000; grouting of the foundation and abutments, \$20,000; and \$159,800 for riprap, drains, positive cutoff, outlet channel, seeding, municipal water outlet gate, and other similar items.

The construction costs for the basic recreation facilities for structure No. 13 is estimated to be \$714,900. Items of construction include facilities for both day-use and overnight-use as shown in table 2B. Unit costs for these items were obtained from the West Virginia Department of Natural Resources and are based on bid prices for similar work which they have done throughout the state. Cost-sharing will not be provided for the following items: Olympic-size swimming pool, \$120,000; bathhouse at the swimming pool, \$36,000; parking area at the swimming pool, \$11,700; chain link fence, \$10,350; beach equipment and lighting units, \$2,850; safety buoys, \$1,000; storage building, \$2,000; and maintenance building, \$2,000.

Construction cost estimates for basic facilities in the recreational developments are shown in table 2B. This table does not include costs for engineering services or project administration.

Engineering Services Cost: Costs for engineering services are based on records kept by the state fiscal office, Soil Conservation Service, Morgantown, West Virginia. These costs include surveys, investigations, design and preparation of drawings and specifications.

Public Law 566 will pay the engineering services cost for structure No. 10 estimated to be \$60,900. Engineering services for basic recreation facilities will be provided through contract with a private consulting firm. The local sponsors and the Service will share equally the estimated cost of \$26,200. The Service will provide consultive assistance and available standard drawings to the firm doing the work.

Engineering services costs for structure No. 13 are estimated to be \$61,000, of which P.L. 566 will pay \$55,300. The remaining cost of \$5,700 for the purpose of municipal water will be borne by the City of Ripley. Engineering services will be provided through contract with a private consulting firm. The Service will provide consultive assistance and available standard design drawings to the engineering firm doing the work. Engineering services cost of \$200 for the municipal water outlet gate will be borne by the City of Ripley. Engineering services cost of \$42,800 for the recreational facilities will be borne by the Department of Natural Resources.

Engineering services cost of approximately \$128,800 for the five single-purpose structures will be borne by P.L. 566.

Project Administration Costs: Project administration cost associated with the installation of the structural measures amounts to \$471,900. This includes an estimate of \$17,400 for costs that the sponsoring local organizations may incur such as contract administration, inspection, and other administrative or overhead costs. The P.L. 566 share of the administrative costs is estimated to be \$454,500, which includes the cost for review of engineering plans, government representative, and inspection service during construction to insure that structural measures are installed in accordance with the plans and specifications.

The estimated obligation of project funds for each fiscal year during the installation period is as follows:

Year	P.L. 566			Other		
	Land Treatment	Structural	SRC Road Relocation	Land Treatment	Structural	SRC Road Relocation
1st	21,500	0	0	45,500	0	0
2nd	25,900	1,434,100	98,500	52,700	839,000	76,100
3rd	25,700	1,414,500	109,400	55,700	358,900	180,000
4th	22,600	559,600	0	50,600	69,900	31,500
5th	20,600	209,700	0	41,300	23,600	15,600
Total	116,300	3,617,900	207,900	245,800	1,291,400	303,200

EFFECTS OF WORKS OF IMPROVEMENT

The combined effects of project land treatment measures, structural measures for flood prevention, recreation and municipal water supply, and sediment detention, along with proper maintenance, will solve the major problems of soil and water resource management throughout the watershed. It is expected that these measures will (1) reduce damage from flooding, sedimentation, and erosion; (2) reduce the amount of maintenance to roads and bridges, (3) eliminate periodic shortages of municipal water, (4) provide for much needed recreational activities in the west-central section of the state, (5) create new job opportunities, (6) increase economic

opportunities for low-income families, (7) stimulate improvement of personal properties; and (8) create a sense of community pride. It is also expected that the city will make an extreme effort to get industries to locate in the Ripley area. More than 376 properties will receive direct floodwater damage reduction benefits.

Land treatment measures, when established, will contribute substantially to damage reduction and beautification of the area. It is expected that idle land will be upgraded and changed to higher use.

The key storm of March 1967 in which 30 first floors of homes and businesses were flooded will be contained within bank.

In the Mill Creek area the proposed project will provide the 100-year level of protection to the first floors of all present homes and businesses. Insignificant remaining damages will be to low-lying areas such as lawns and gardens. The reduced threat of flooding attained by the works of improvements is expected to bring about a considerable improvement and increased value of residential and commercial properties in the flood plain. The 100-year present condition peak flow in Ripley would be 15,900 cfs. With the project, the same peak flow would be 5,900 cfs. With the project installed, the 50-year frequency storm will be contained within bank. The bank-full capacity is 5,000 cfs. It is very impractical to construct a channel to handle the 100-year frequency storm due to the extremely high cost to the government without accruing any more benefits to the channel.

A low area in the vicinity of the gas maintenance building just south of Highway 33 will continue to receive some minor flooding from the 100-year flood with the project installed. Damage will be minor, however, since this is a maintenance shop and most equipment is not susceptible to damage from floodwater.

In the Sycamore addition, the major problem is backwater from Mill Creek. This will be eliminated with the project. All first-floor flooding from the 100-year storm will be prevented in this area with the project.

In the agricultural reaches, 483 acres which now receive flooding about every 5 years will be flood-free. An estimated 85 percent of floodwater damages to farm roads, homes, buildings, fences, etc. will be eliminated.

The developments at structure No. 13 and structure No. 10 will provide facilities for such activities as fishing, boating, picnicking, swimming, and walking for pleasure.

The picnic season generally extends from the middle of May to October and later, depending on weather conditions. At site No. 13, calculated estimates of annual visitor-days for picnicking and other activities is 320,500. The calculated annual visitor-days for site No. 10 is 88,000. The peak daily use is 1,900 and 10,600 for site No. 10 and site No. 13 respectively, and the value per user day is \$1.50 for both sites.

An additional effect of this project will be the creation of part-time and full-time jobs associated with operation and maintenance of such developments. Increased bait and boat sales and rental is also expected along with picnic supplies, fishing equipment, and gasoline sales.

The reduced threat of flooding attained by the works of improvement is expected to bring about a considerable improvement within the city of Ripley. Within the flood plain area, real estate will increase in value.

Industries that are reluctant to locate in Ripley because of flood problems will be more inclined to do so with the threat of flooding reduced.

In order to provide for more adequate water supply, the city of Ripley has decided to include municipal water in multiple-purpose structure No. 13. The municipal water storage in this structure amounts to 1,061 acre-feet or 346 million gallons. This would enable the city of Ripley to serve 3,000 additional users. Water quality will be adequate with present treatment.

The impoundments will have no significant adverse effects on the present fisheries, while opportunity for increasing these resources at sites No. 4, 5, 6, 8, and 9 is possible. The pools on site No. 10 and No. 13 are expected to be very productive warm-water fisheries, which will give a tremendous relief to the fishing pressure in the Ripley area. It is to be expected that water management measures applied to the head-water region will benefit the downstream fishery by lessening siltation and reducing high flows.

As presently envisioned, the project will result in improvement of wildlife resources. Land treatment measures that restore food and cover through controlled grazing and reforestation will measurably improve wildlife habitat.

A small area located along Sycamore Branch between U.S. Highway 21 and Mill Creek will still receive flooding from a 100-year frequency event. This area will be inundated with approximately 2 feet of water. Flood routings indicate that the 100-year flood will crest at elevation 595 msl in this area after project installation. Development of homes or businesses with first-floor elevation lower than elevation 595 will be restricted by city ordinance. This area is shown on the urban flood plain map in the back of this work plan.

PROJECT BENEFITS

Land treatment will provide substantial economic and aesthetic values. The proposed forest land treatment measures will improve the hydrologic condition of the forest land. This will reduce sediment and retard storm runoff. Good forest management and continued fire protection will also increase the productivity of the forest lands.

Maintenance of adequate tree cover throughout Ripley's urbanized area will help to improve the environmental conditions and make the developed area a better place to live.

Land treatment benefits from reduced floodwater damages are estimated to be \$5,800 annually.

Estimated average annual monetary floodwater damages within the watershed will be reduced from \$175,700 to \$7,200, an overall reduction of 96 percent. Direct floodwater reduction benefits are estimated to amount to \$148,800 annually.

Sediment damage reduction benefits will accrue to the Ohio and other navigable downstream channels. The monetary value of this is not measurable at this time even though the amount is expected to be substantial.

Within the vicinity of Ripley, 200 acres will be made flood-free, which is estimated to yield a benefit of \$91,300 annually, which is attributed to savings in flood plain development costs compared to upland development costs. Storage benefits of municipal and industrial water have been estimated at \$17,200 annually.

More than half of the benefits of this project will accrue to recreation. Recreational developments at structures No. 10 and No. 13 are calculated to be complementary in use and will receive about 408,500 visits annually. Planned activities include fishing, boating, swimming, camping, picnicking, and nature walks. At \$1.50 per visitor day, the recreational benefits will amount to \$523,800 annually.

Studies show that parks stimulate the economy by attracting people who spend money enroute and in the vicinity. "Having a park in the community is like having an additional industrial plant in the area" says Bill Miller, Florida State Park Director. He has just made a survey of 3,500 park visitors. Visitors to parks buy gas, oil, food, lodging, and other items on the way. One survey indicated that 83 percent of the overnight park visitors actually spent money outside the park while staying in the campground.

Local secondary effects stemming from the project were computed as a percent of direct primary benefits and amount to \$78,100 annually. Secondary benefits from a national viewpoint were not considered pertinent to economic evaluation.

Redevelopment benefits were estimated to be \$62,300. This includes employment opportunities expected to be created during installation of the works of improvement and labor for operation and maintenance for a 20-year period following installation. Additional employment benefits will stem from the installation and use of supplemental improvements induced by the project. Total average annual benefits from structural measures and land treatment amount to \$941,200. Benefits of this plan do not duplicate those which will accrue to the clearing and snagging project of the Corps of Engineers.

COMPARISON OF BENEFITS AND COSTS

Total annual benefits from structural measures total \$935,400 including secondary benefits of \$78,100. The average annual cost amounts to \$330,300, producing a total benefit-cost ratio of 2.8 to 1.

Without secondary benefits, the ratio is 2.6 to 1. Table 6 shows the comparison of total benefits and costs for the structural measures included in this work plan.

PROJECT INSTALLATION

The installation period for land treatment and structural measures included in this plan is 5 years. The proposed order of installation for the works of improvement is as follows:

- First year - Land treatment
- Second year - Land treatment and structures No. 13 and No. 4
- Third year - Land treatment and structures No. 10 and No. 5
- Fourth year - Land treatment and structures No. 6 and No. 8
- Fifth year - Land treatment and structure No. 9

Responsibilities for installation of project measures are listed below.

Land Treatment

These measures on private land will be installed by individual landowners. The Western and Little Kanawha Soil Conservation Districts will have overall responsibility for installation of measures within their respective boundaries. To accelerate land treatment, individual landowners will be encouraged to become cooperators with the districts and participate in total resource conservation. Maximum use will be made of public meetings, news articles, television, and radio to emphasize the importance of land treatment. Technical assistance for planning and installation of land treatment measures will be provided the landowners through the districts as it is available from cooperating agencies.

The Western Soil Conservation District will be responsible for installing vegetative measures on critical eroding roadbanks.

Forest land treatment measures will be installed by the landowners with technical assistance furnished by the West Virginia Department of Natural Resources, in cooperation with the U. S. Forest Service. The amount of assistance furnished for planning, developing, and managing trees and related plant communities will be determined and influenced by the needs and desires of the sponsors and the landowners.

The following requirements of land treatment will be met before financial assistance will be provided for installation of structural measures:

1. The Western and Little Kanawha Soil Conservation Districts shall obtain agreements to carry out recommended soil and water conservation measures and proper conservation plans on not less than 50 percent of the land situated in the drainage area above each retention reservoir to be installed with federal assistance.
2. Sponsoring local organizations will be responsible for installation of land treatment measures on critically eroding areas which, if not controlled, would require a material increase in the cost of construction and operation and maintenance of the structural measures. Not less than 75 percent of the land treatment measures on these critical areas must be installed or installation begun prior to construction of the works of improvement.

Structural Measures

General responsibilities for installation of structural measures are shown in the work plan agreement. Individual responsibilities are shown below:

1. Western Soil Conservation District will obtain landrights for structure Nos. 4, 5, 6, 8, and 9.
2. The Department of Natural Resources will:
 - a. Obtain all landrights for structure No. 13 and basic recreation facilities. Cost share percentages with the Service are shown in the work plan agreement.
 - b. Provide at its expense engineering services for the basic recreation facilities at structure No. 13.
3. The City of Ripley will:
 - a. Provide at its expense engineering services for the installation of the water outlet gate.
 - b. Enter into an A & E contract with the Service and private consultant to provide engineering services for structure No. 13. The City and Service will share the cost as shown in the work plan agreement.
4. The Jackson County Court will:
 - a. Obtain landrights for structure No. 10 and basic recreation facilities. The cost will be shared with the Service as shown in the work plan agreement.

- b. Enter into an A & E contract with the Service and private consultant to provide engineering services for the basic recreation facilities on structure No. 10. The cost will be shared with the Service as shown in the work plan agreement.
5. The Soil Conservation Service will:
 - a. Provide at its expense engineering services for structures No. 4, 5, 6, 8, 9, and 10.
 - b. Enter into an A & E contract with the City of Ripley to provide engineering services for structure No. 13. The Service will be responsible for the required actions to obtain an approved consultant. The cost will be shared with the City as shown in the work plan agreement.
 - c. Enter into an A & E contract with the Jackson County Court to provide engineering services for the basic recreation facilities at structure No. 10. The Service will be responsible for the required actions to obtain an approved consultant. The cost will be shared with the Court as shown in the work plan agreement.

The Service and sponsors will each bear the project administration costs they incur. The Western Soil Conservation District will have overall responsibility for contract administration on structures No. 4, 5, 6, 8, and 9. By formal request the Service will administer the contracts for these structures.

The Department of Natural Resources is responsible for overall contract administration on structure No. 13 and the accompanying basic recreation facilities. By formal request from the Department, the Service will administer the contract for this structure. The basic recreation facility contract will be administered by the Department. The City of Ripley will be responsible for contract administration for the water outlet gate at this site.

The Jackson County Court has overall responsibility for contract administration for the basic recreation facilities at structure No. 10. By formal request, the Service will administer the contract for these facilities and also for structure No. 10.

The legal adequacy of land purchase, easements, and permits will be determined by the sponsoring local organization with the stated responsibility.

Each sponsoring local organization has the authority under applicable state law to exercise the right of eminent domain to acquire land rights, including relocations or modifications of existing improvements to be installed with Federal assistance.

Project agreements will be entered into between the sponsoring local organizations and the Service before starting the construction of each structural measure. The agreements will show in detail the arrangements and conditions applicable to the specific measure under consideration.

FINANCING PROJECT INSTALLATION

Federal assistance in carrying out the project works of improvement will be provided under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, 68 Stat. 666) as amended. The financial and technical assistance to be furnished by the Soil Conservation Service and other Federal agencies is contingent upon the appropriation of funds for this purpose. Before P.L. 566 funds are made available to the sponsoring local organizations, they will:

1. Give assurance that all land rights necessary for project installation have been secured.
2. Execute a Project Agreement.
3. Execute an Operation and Maintenance Agreement.
4. Execute an Engineering Services Agreement (Structure No. 13 and the basic facilities at structure No. 10).

Monies for financing project installation will be obtained as follows:

Land Treatment

The total cost for installing land treatment measures is estimated to be \$362,100. Of this amount, P.L. 566 funds will pay \$116,300 and other funds \$245,800. The total cost of installing forest land treatment measures is estimated to be \$166,200. Technical assistance to forest landowners for the installation of forestry measures will cost \$78,400. This amount will be provided as follows: \$63,100 under P.L. 566, \$11,800 as the State's share of the P.L. 566 Accelerated Program, and \$3,500 under the Cooperative Forest Management Program. The remaining \$87,800 is the installation cost to the landowners.

Costs involved in the installation of land treatment measures on private lands will be borne by the landowners from their own resources and from Agricultural Conservation Program (ACP) cost-sharing on approved practices. Public Law 566 funds will provide the technical assistance necessary for accelerated installation of these measures.

Land treatment funds under Section 203 of the Appalachian Regional Development Act of 1965 have been made available to the landowners in the watershed during the 1969 fiscal year. If these funds continue to be available, they will be used to accelerate land treatment measures proposed in this plan.

The total cost for revegetating critical areas on roadbanks is estimated to be \$12,000. Of this amount, P.L. 566 will pay the cost of materials,

and the cost of labor and equipment will be borne by the Western Soil Conservation District. The District expects to finance their share through arrangements with the West Virginia State Road Commission.

The Farmers Home Administration will give special consideration to eligible farm families in the way of credit and farm management guidance to establish necessary land treatment measures. This assistance may vary over the years as regulations pertaining to FHA loan programs are altered to meet changing conditions.

Structural Measures

The Western Soil Conservation District will finance the \$311,500 land rights costs on the five floodwater retarding dams as follows:

1. It is expected that easements will be donated on a large portion of the land needed.
2. The State of West Virginia has assisted local sponsors on watersheds throughout the state. Their assistance on land rights costs is anticipated.
3. The State Road Commission has made considerable financial contribution in relocating roads and bridges in other projects throughout the state. It is assumed they will continue their assistance in relocating roads for these structures. The estimated cost is \$123,100.
4. Utility companies are expected to cooperate with the district in relocating their facilities as they have on other watersheds. The estimated cost is \$20,900.
5. Local contributions from property owners in the watershed are expected to assist with these costs. The Mill Creek Watershed Association will conduct fund raising campaigns as needed.

The Department of Natural Resources will obtain monies for their share of structure No. 13 from state revenue. The estimated total cost to the Department is \$582,100. This does not include the estimated cost of road relocation allocated to recreation, of which \$98,500 is the local share that may be financed by the State Road Commission.

The City of Ripley will finance their share of structure No. 13 by obtaining an FHA loan. Their share is estimated to be \$114,300 for municipal water and \$8,500 for flowage easements. Negotiations are presently underway with the state director of the Farmers Home Administration. The loan will be used to finance water supply storage in the structure.

The Jackson County Court will finance their share of structure No. 10 from present tax revenue. Their share of the cost is estimated to be \$409,800. They are also expecting some financial assistance from the State Road Commission in relocating roads, of which the local share is \$109,350.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment

Land treatment measures will be maintained by landowners or operators of the tracts or farms on which the measures are installed under agreement with the Western Soil Conservation District and the Little Kanawha Soil Conservation District. Technical assistance for maintenance of land treatment measures will be furnished landowners through the districts as it is available from cooperating agencies.

Forest land treatment measures will be maintained by landowners. Technical assistance will be provided by the West Virginia Department of Natural Resources, in cooperation with the U.S. Forest Service under the going Cooperative Forestry Programs.

Roadbanks stabilized under this plan will be maintained by the Western Soil Conservation District. These areas consist of about 40 acres of actively eroding banks and are shown on the project map. Maintenance will consist of weed control and treatment required to maintain a good vegetative cover.

Structural Measures

The Jackson County Court will be responsible for and perform operation and maintenance of the five single-purpose floodwater retarding structures No. 4, 5, 6, 8, and 9. This cost is estimated to be \$1,000 annually. Some of the more common maintenance items on these structures could be as follows:

1. Repair eroded areas and small slides in the vicinity of the earth embankment and emergency spillway.
2. Clean trash racks and remove floating debris.
3. Mow dam and emergency spillway area each year.
4. Seed and mulch bare areas.
5. Topdress the fill and emergency spillway with lime and fertilizer as needed.
6. Repair riprap and concrete as needed.
7. Clean stilling basin and outlet channel.
8. Maintain fences.
9. Keep a record of operations and maintenance costs.

The Jackson County Court will be responsible for operating and maintaining multiple-purpose structure No. 10. Estimated average annual

operation and maintenance cost of this structure and recreational development is \$15,700. This cost consists of an estimated \$200 annually for maintenance of the dam and emergency spillway and reservoir and \$15,500 annually to cover replacement cost of basic recreational facilities, stocking of the lake, salaries of operating personnel, sanitation, and safety of the recreation complex.

The West Virginia Department of Natural Resources and the City of Ripley will jointly be responsible for operation and maintenance of multiple-purpose structure No. 13, which is estimated to be \$47,100 annually. This cost consists of \$500 for operation and maintenance of the dam and emergency spillway and municipal water supply pool, and \$46,600 for operation and maintenance of basic recreational facilities and reservoir (including stocking of the lake, salaries, sanitation, safety, and replacement costs.)

The City of Ripley will operate and maintain the dam and emergency spillway and municipal water features of the dam to include release of water from the structure for municipal purposes. To insure against withdrawal of recreation water the operating range of the municipal pool has been estimated to be between elevation 642.8 at a surface area of 200 acres and elevation 635.2 at a surface area of 150 acres. Capacity of municipal storage within this range is 1,400 acre-feet of which 650 acre-feet is for municipal purposes and 750 acre-feet to allow for evaporation and seepage losses from both the recreation and municipal pools. Withdrawal of this amount of storage would indicate a fluctuation in pool level of approximately 7.6 feet; however, this would occur very infrequently. Yearly fluctuation which could be expected would be about 2.0 feet occurring mostly from evaporation and seepage. A search of records dating back to 1930 revealed only one one-month period when pool fluctuation would have been as much as 3.5 feet.

Common items of maintenance for the two multiple-purpose structures will be the same as those listed for the single-purpose structures.

Some of the more basic items of operation for the recreational development will be as follows: (1) regulating the number of users to insure that overuse does not diminish the aesthetic value of the environment; (2) confining travel of motor vehicles to designated areas and controlling speed; (3) keeping each recreation facility clean and sanitary; (4) disposing of garbage and other refuse as often as necessary; and (5) eliminating all safety hazards such as dangerous trees and toxic plants. Items of maintenance include (1) reseeding areas to eliminate erosion; (2) maintaining vigorous grass growth with fertilizer; (3) mowing grass when needed; and (4) regularly servicing and maintaining facilities such as toilets, boat docks, picnic tables, and grills.

The West Virginia Department of Natural Resources will be responsible for operation and maintenance of recreational basic facilities that are to be used by the general public on site No. 13.

Both the Jackson County Court and the West Virginia Department of Natural Resources expect to establish a schedule of fees to help defray

operation and maintenance costs. This schedule of maximum admission or user fees and other requirements for operation and maintenance of recreation facilities will be mutually agreed to by local organizations and the Service and set forth in the Operation and Maintenance Agreement. This fee will be limited to that which is required to amortize the local investment and to provide for adequate operation and maintenance.

If it is found that there is a continuing need for use of recreational storage in sites No. 10 and No. 13 for other purposes, the local organizations must notify the Service, through the State Conservationist. The local sponsoring organizations must agree to reimburse the federal government for all P.L. 566 funds used for public recreation costs associated with the reservoir and recreational facilities if this becomes necessary.

Structural works of improvement will be jointly inspected for the first three years by the concerned sponsoring local organization and representatives of the Soil Conservation Service. These inspections will be made annually and also after every major storm or other occurrence that might adversely affect the structures. Inspections after the third year will be made annually by the sponsors. The sponsor will furnish the Service a written report of each inspection.

Specific maintenance agreements will be entered into between local sponsoring organizations and the Service prior to issuance of an invitation to bid. These agreements will give in detail requirements for operation and maintenance, inspection, records, and reports.

In order to prevent future flooding due to changed conditions in the city of Ripley, it will be necessary to maintain the stream channel in its present condition or better. The city will restrict encroachment on the present stream and remove brush, debris, and sediment so as to maintain the present capacity.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST

Mill Creek Watershed, West Virginia

Installation Cost Item	:	:	Estimated Cost (Dollars) ^{1/}			Total
			No.:	Non-Fed.:	P.L. 566:	
	:	Land	Funds			
<u>LAND TREATMENT</u>						
Soil Conservation Service						
Cropland	Ac.	150	0	9,800		9,800
Grassland	Ac.	2,000	0	51,200		51,200
Miscellaneous Land	Ac.	260	0	34,600		34,600
Critical Area	Ac.	140	6,000	21,800		27,800
Technical Assistance	--	--	47,200	25,300		72,500
SCS Subtotal	--	--	53,200	142,700		195,900
Forest Service						
Forest Land	Ac.	18,565	--	87,800		87,800
Technical Assistance	--	--	63,100	15,300		78,400
FS Subtotal	--	--	63,100	103,100		166,200
TOTAL LAND TREATMENT	--	--	116,300	245,800		362,100
<u>STRUCTURAL MEASURES</u>						
<u>Construction</u>						
Floodwater Retarding Strs.	No.	5	1,218,000	0		1,218,000
Multiple-Purpose Structures	No.	2	1,094,400	124,300		1,218,700
Recreation Facilities	--	--	395,200	583,100		978,300
Subtotal Construction	--	--	2,707,600	707,400		3,415,000
Engineering Services - SCS	--	--	258,100	61,800		319,900
Subtotal - Engineering	--	--	258,100	61,800		319,900
<u>Project Administration - SCS</u>						
Construction Inspection	--	--	355,000	16,300		371,300
Reviewing & Servicing A & E Contracts	--	--	2,500	0		2,500 ^{2/}
Other	--	--	97,000	1,100		98,100
Subtotal - Administration	--	--	454,500	17,400		471,900
<u>Other Costs</u>						
Land Rights	--	--	405,600	808,000		1,213,600
Subtotal - Other	--	--	405,600	808,000		1,213,600
TOTAL STRUCTURAL MEASURES	--	--	3,825,800	1,594,600		5,420,400
Total Project	--	--	3,942,100	1,840,400		5,782,500
Summary						
Subtotal SCS	--	--	3,879,000	1,737,300		5,616,300
Subtotal FS	--	--	63,100	103,100		166,200
TOTAL PROJECT	--	--	3,942,100	1,840,400		5,782,500

^{1/} Price Base - 1968.

^{2/} Architectural and Engineering Agreement for installation of recreational facilities at structure No. 10.

TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT

(At Time of Work Plan Preparation)

Mill Creek Watershed, West Virginia

Measures	Unit	Applied to Date	Total Cost (Dollars) <u>1/</u>
<u>LAND TREATMENT - SCS</u>			
Conservation Cropping Systems	Ac.	164	7,380
Critical Area Planting	Ac.	15	3,750
Diversions	Ft.	28,055	7,014
Ponds	No.	174	87,000
Hedgerow Planting	Ac.	462	22,750
Mulching	Ac.	6	360
Pasture and Hayland Management	Ac.	2,287	6,851
Pasture and Hayland Planting	Ac.	6,342	443,940
Pasture, Proper Use	Ac.	2,299	6,854
Spring Development	No.	92	4,600
Streambank Protection	Ft.	19,825	4,262
Stream Channel Improvement	Ft.	38,525	38,525
Tile Drains	Ft.	47,985	10,556
Trough or Tank	No.	130	11,050
Wildlife Habitat Development	Ac.	175	8,750
Clearing and Snagging	Ft.	3,500	7,000
Drainage Field Ditch	Ft.	2,500	500
Drainage Mains or Laterals	Ft.	5,860	1,758
Recreation Land Grading & Shaping	Ac.	1	300
Subtotal - SCS	--	--	673,200
<u>LAND TREATMENT - FS</u>			
Tree Planting	Ac.	253	13,200
Hydrological Cultural Operations	Ac.	320	5,600
Woodland Grazing Control	Mi.	1.4	
	Ac.	1,000	1,000
Fire Control	Ac.	70,838	70,800
Subtotal - FS	--	72,411	90,600
TOTAL	--	--	763,800

1/ Price Base - 1968.

January 1970

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Mill Creek Watershed, West Virginia

(Dollars) $\frac{1}{2}$

Item	Installation Cost - P.L. 566 Funds			Installation Cost - Other Funds			Total
	Construc- tion	Engi- neering	Land Rights	Construc- tion	Engi- neering	Land Rights	
Floodwater Retarding Strs.							
No. 4	289,200	28,900	0	318,100	0	37,900	356,000
No. 5	329,400	32,900	0	362,300	0	133,000	495,300
No. 6	246,400	24,600	0	271,000	0	84,600	355,600
No. 8	191,700	23,000	0	214,700	0	16,800	231,500
No. 9	161,300	19,400	0	180,700	0	39,200	219,900
Multiple-Purpose Strs.							
No. 10	565,800	60,900	183,000 $\frac{2}{1}$	809,700	43,200	202,700 $\frac{3}{1}$	1,055,600
Recreation Facilities	130,700	13,100	16,200	160,000	130,700	13,100	160,000
Subtotal Str. No. 10	696,500	74,000	199,200	969,700	173,900	218,900	1,375,600
No. 13	528,600	55,300	192,800 $\frac{4}{1}$	776,700	81,100	250,800 $\frac{5}{1}$	1,114,300
Water Intake	0	0	0	0	2,000	0	2,200
Recreational Facilities	264,500	0	13,600	278,100	450,400 $\frac{6}{1}$	42,800	520,000
Subtotal Str. No. 13	793,100	55,300	206,400	1,054,800	533,500	277,600	1,914,600
Subtotal	2,707,600	258,100	405,600	3,371,300	707,400	808,000	4,948,500
Multiple-Purpose Strs.							
Project Administration	--	--	--	454,500	--	--	17,400
GRAND TOTAL	2,707,600	258,100	405,600	3,825,800	707,400	808,000	5,420,400

$\frac{1}{2}$ Price Base - 1968.

$\frac{2}{1}$ Includes the cost of relocations (\$152,100).

$\frac{3}{1}$ Includes the cost of relocations (\$152,100); flowage easements, legal fees, and land surveys (\$19,700).

$\frac{4}{1}$ Includes the cost of relocations (\$168,900).

$\frac{5}{1}$ Includes the cost of relocations (\$210,100); flowage easements, legal fees, and land surveys (\$11,000).

$\frac{6}{1}$ Includes the cost of some basic facilities which are not eligible for cost sharing (\$185,900).

$\frac{7}{1}$ Includes the cost of legal fees, land, and land surveys which are not eligible for cost sharing (\$13,200).

TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY

Mill Creek Watershed, West Virginia

(Dollars) 1/

	COST ALLOCATION			COST SHARING			P. L. 566			Other		
	Flood : Prevention :	M & I : Water :	Total :	Flood : Prevention :	M & I : Water :	Total :	Flood : Prevention :	M & I : Water :	Total :	Flood : Prevention :	M & I : Water :	Total :
Single-Purpose Nos. 4, 5, 6, 8, 9	1,658,300	0	1,658,300	1,346,800	0	1,346,800	311,500	0	311,500	0	0	311,500
Multiple-Purpose Str. No. 10	594,000	461,600	1,055,600	574,900	234,800	809,700	19,100	226,800	245,900	0	0	245,900
Str. No. 13	563,800	440,200	1,004,000	555,300	221,400	776,700	8,500	218,800	339,800	112,500	112,500	339,800
Recreational Facilities	0	320,000	320,000	0	160,000	160,000	0	160,000	160,000	0	0	160,000
Str. No. 10	0	798,100	798,100	0	278,100	278,100	0	278,100	520,000	0	0	520,000
Str. No. 13	0	0	0	0	0	0	0	0	0	0	0	0
GRAND TOTAL	2,816,100	2,019,900	4,836,000	2,477,000	894,300	3,371,300	339,100	1,125,600	1,577,200	112,500	112,500	1,577,200

1/ Price base - 1968.

January 1970

TABLE 2B - RECREATION FACILITIES

ESTIMATED CONSTRUCTION COSTS

Mill Creek Watershed, West Virginia

(Dollars) $\frac{1}{2}$

Structure No. 10 Item Description	Number & Units	Unit Cost	Total Cost
Picnic Units--grading, 2-8' wood tables with grill and trash racks	50 each	\$ 325.00	\$ 16,250
Picnic Shelters--10 tables with fireplace and concrete floor.	4 each	7,000.00	28,000
Playground Units--grading and playground apparatus	4 each	1,650.00	6,600
Boat Dock, 8' x 100'	1 each	3,000.00	3,000
Boat Ramp, 16' wide	1 each	1,500.00	1,500
Fishing Pier, 12' x 50' with guard rails.	1 each	1,800.00	1,800
Fish Cleaning Facilities	1 each	200.00	200
Parking Areas--materials, labor, grading and drainage for 4 lots	6,900 sq. yds.	2.50	17,250
Roads--materials, labor, grading, black topping and drainage for 2 lanes.	4,300 L.Ft.	9.22	39,600
Sanitary Building with rest room divided for men and women	3 each	10,000.00	30,000
Sewage System--Extended aeration treatment plants			
6,000 gpd capacity	1 Job	21,900.00	21,900
5,000 gpd capacity	2 Job	21,800.00	43,600
Water Supply System--storage capacity, well, pump, pipe lines, chlorinator, drinking fountains and fittings.	3 Job	8,300.00	24,900
Foot Trail	15,800 L.Ft.	0.50	7,900
Control Gate	4 each	500.00	2,000
Entrance Control Booth	3 each	500.00	1,500
Foot Bridge	1 each	1,500.00	1,500
Benches	10 each	40.00	400
Signs and Markers--entrance, directional and informational.	1 Job	2,000.00	2,000
Recreation Plantings	1 Job	4,000.00	4,000
Incinerator	1 each	1,500.00	1,500
Electric Power	1 Job	2,000.00	2,000
Chain Link Fence	640 L.ft.	6.25	4,000

Subtotal Structure No. 10

261,400

Structure No. 13

Item Description	Number & Units	Unit Cost	Total Cost
Camping Units--grading, gravel spur, table, fireplace, and trash rack.	118 units	\$ 260.00	\$ 30,600
Primitive Camping Units--grading, table, fireplace, and trash racks.	15 units	100.00	1,500
Picnic Units--grading, 8-foot table, fireplace, and trash racks.	100 units	170.00	17,000
Boat Docks			
Main Launch Area	1 each	7,000.00	7,000
Primitive Area	2 each	2,550.00	5,100
Boat Ramp--50' x 100'	1 each	2,000.00	2,000
Landscaping--grading, shaping, seeding, and planting	1 job	8,000.00	8,000
Trash Racks	33 each	20.00	660
Bath House--open roof, sanitary facilities, aerobic digester, and disposal field.	2 each	35,500.00	71,000 ^{2/}
Sand Blanket--6 to 8 inches deep.	61,000 sq. ft.	0.10	6,100
Chain Link Fence			
6 feet high	1,605 L.Ft.	6.00	9,630 ^{3/}
4 feet high	180 L.Ft.	4.00	720 ^{3/}
Concrete Work--steps, ramps, walks, hand-rails, patio, & fish cleaning facilities	1 job	8,300.00	8,300
Beach Equipment--diving platform, life-guard stands, floating walk, and safety buoys.	1 job	3,000.00	3,030 ^{4/}
Beach Slides			
30 feet long	1 each	1,200.00	1,200
10 feet long	1 each	500.00	500
Beach Lighting Units--incandescent 100 watt on 20-foot poles	6 each	475.00	2,850 ^{3/}
Game Courts--grading, labor, materials, painting, and drainage			
Asphalt 78' x 36'	2 each	2,000.00	4,000
Asphalt 94' x 50'	1 each	2,500.00	2,500
Grassed	2 acres	500.00	1,000
Playground Apparatus	1 job	3,000.00	3,000
Shelter--renovation and relocation of log cabin.	1 job	1,500.00	1,500
Swimming Pool--Olympic size	1 job	120,000.00	120,000 ^{3/}
Sanitary Building--			
Camp areas	3 each	12,000.00	36,000
Picnic and boat launch area	2 each	7,000.00	14,000
Game court area	1 each	4,000.00	4,000
Septic Tank and Disposal Fields	4 job	4,000.00	16,000
Sanitary Dump Station	2 each	500.00	1,000
Sewage Treatment System	1 job	25,000.00	25,000
Pit Toilets--trails and primitive areas	10 each	400.00	4,000

Structure No. 13 (continued)

Item Description	Number & Units	Unit Cost	Total Cost
Water Supply System--wells, pumps, pipe line, chlorinators, fountains, trenching, valves, and fittings.	L.S. 5/		27,744
Water Storage Tank--200,000 gal- lon capacity	1 each	20,000.00	20,000
Parking Area--materials, grading, labor and drainage.			
Asphalt Lots	16,450 sq.yds.	4.50	74,025 6/
Gravel Lots	600 sq.yds.	1.40	840
Roads--materials, grading, labor, and drainage,			
Asphalt - 20' wide	12,220 L.Ft.	9.37	114,548
Gravel - 20' wide	4,600 L.Ft.	6.20	28,520
Gravel - 10' wide	1,830 L.Ft.	3.10	5,673
Nature Trail	7,800 L.Ft.	0.20	1,560
Fisherman's Trail	5.5 mi.	1000.00	5,500
Overlook Barriers	5 each	200.00	1,000
Signs and Markers	1 Job	2,800.00	2,800
Incinerator	1 each	1,500.00	1,500
Electric Power Supply--buried line, trench and transformer	4,000 L.Ft.	5.00	20,000
Storage Building	1 each	2,000.00	2,000 3/
Maintenance Building	1 each	2,000.00	2,000 3/
Subtotal Structure No. 13			714,900
Grand Total			976,300

- 1/ Price Base 1968.
- 2/ Includes the cost of a bath house at swimming pool which is not eligible for cost sharing (\$36,000).
- 3/ The cost of recreational facilities which are not eligible for cost-sharing (6 items, \$137,200).
- 4/ Includes the cost of buoys in the beach area, which are not eligible for cost sharing (\$1,000).
- 5/ Lump Sum
- 6/ Includes the cost of parking area at swimming pool, which is not eligible for cost sharing (\$11,700).

October 1969

TABLE 3 - STRUCTURE DATA

FLOODWATER RETARDING STRUCTURES AND WATER SUPPLY RESERVOIRS

Mill Creek Watershed, West Virginia

ITEM	UNIT	STRUCTURE NO.							TOTAL
		4	5	6	8	9	10	13	
Class of Structure	Sq. Mi.	3.25	6.67	4.44	2.68	4.82	26.40	52.34	XXX
Drainage Area		76	76	76	76	76	76	76	100.56
Curve No. (1-day) (AMC II)	Hrs.	1.32	2.21	1.40	1.50	1.90	7.13	8.75	XXX
Tc		675.3	683.3	719.5	727.7	723.4	658.8	679.0	XXX
Elevation Top of Dam	Ft.	671.0	671.0	702.0	716.4	712.0	646.0	665.1	XXX
Elevation Crest Emergency Spillway	Ft.	639.3	645.6	672.0	693.4	684.6	629.3	642.8	XXX
Elevation Crest of Riser	Ft.	50.3	51.3	63.4	54.0	57.4	54.3	71.0	XXX
Maximum Height of Dam	Cu. Yds.	128,100	205,500	134,100	70,700	70,400	311,800	219,200	1,139,800
Volume of Fill	Ac. Ft.	999	1,740	1,520	693	1,293	7,550	11,256	25,011
Total Capacity	Ac. Ft.	71	121	94	64	95	310	469	1,224
Sediment Submerged 1st 50 years	Ac. Ft.	68	105	90	61	92	264	354	1,034
Sediment Submerged 2nd 50 years	Ac. Ft.	7	12	10	7	9	46	66	157
Sediment Aerated	Ac. Ft.	--	--	--	--	--	1,075 2/4	876 3/4	1,951
Recreation	Ac. Ft.	--	--	--	--	--	--	1,061	1,061
Water Supply	Ac. Ft.	813	1,502	1,326	561	1,097	5,855	8,430	19,584
Retarding	Ac. Ft.	--	--	--	--	--	--	--	--
Surface Area	Ac. Ft.	13.8	26.2	18.2	10.0	15.8	72.5	66.0	222.5
Sediment pool	Acres	--	--	--	--	--	200.0	150.0	350.0
Recreation pool	Acres	--	--	--	--	--	--	200.0	200.0
Water supply pool	Acres	54.0	113.0	76.8	43.2	76.8	475.0	564.0	1,402.8
Retarding pool 1/	Acres	--	--	--	--	--	--	--	--
Principal Spillway									
Rainfall Volume (areal) (1-day)	In.	5.22	5.15	5.22	5.22	5.15	4.96	4.93	XXX
Rainfall Volume (areal) (10-day)	In.	8.91	8.88	8.91	8.91	8.88	8.73	8.67	XXX
Runoff Volume (areal)	In.	5.08	5.15	5.17	5.08	5.15	5.02	4.79	XXX
Runoff Volume (10-day)	In.	108	172	123	69	120	613	947	XXX
Capacity (Max.)	cfs.	1	1	1	1	1	1	1	XXX
Frequency operation - ESW	% chance	30	36	30	24	30	twin 48	twin 54	XXX
Size of Conduit	Dim. In.								
Emergency Spillway									
Rainfall Volume (ESH) (areal)	In.	9.87	9.90	9.90	9.87	9.90	9.50	9.50	XXX
Runoff Volume (ESH)	In.	6.89	6.91	6.91	6.89	6.91	6.54	6.54	XXX
Type		Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Rock	XXX
Bottom Width	Ft.	110	150	40	100	140	250	400	XXX
Velocity of flow (Ve)	Ft./Sec.	8.7	8.3	7.2	8.6	8.7	8.0	10.0	XXX
Slope of exit channel	Ft./Ft.	0.02	0.02	0.02	0.02	0.02	0.02	0.02	XXX
Maximum water surface elevation	Ft.	667.7	674.2	704.4	719.7	715.3	649.4	669.5	XXX
Freeboard									
Rainfall Volume (FH) (Areal)	In.	26.28	26.30	26.30	26.28	26.30	25.40	25.20	XXX
Runoff Volume (FH)	In.	22.83	22.85	22.85	22.83	22.85	21.96	21.59	XXX
Maximum water surface elevation	Ft.	675.3	683.3	719.5	727.7	723.4	658.8	679.0	XXX
Capacity Equivalents (Total)	In.	5.53	4.89	6.45	4.85	5.04	5.36	4.03	XXX
Sediment Volume	In.	0.84	0.67	0.82	0.92	0.76	0.44	0.32	XXX
Retarding Volume	In.	4.69	4.22	5.63	3.93	4.28	4.16	3.02	XXX
Recreation Volume	In.	--	--	--	--	--	0.76	0.31	XXX
Water Supply Volume	In.	--	--	--	--	--	--	0.38	XXX
Pool at crest of ESW	In.	--	--	--	--	--	--	--	XXX

1/ Pool at crest of ESW

2/ Contains 545 acre-feet for evaporation and seepage losses.

3/ Contains 339 acre-feet for evaporation and seepage losses.

4/ Contains 411 acre-feet for evaporation and seepage losses.

TABLE 4 - ANNUAL COST

Mill Creek Watershed, West Virginia

(Dollars) ^{1/}

Evaluation Unit	Amortization of Installation Cost ^{2/}	Operation and Maintenance Cost	Total
All Structural Measures	243,300	63,800	307,100
Project Administration	23,200	--	23,200
GRAND TOTAL	266,500	63,800 ^{3/}	330,300

^{1/} Price base: Installation 1968, O & M current.

^{2/} 100 years @ 4-7/8 percent interest (.04917).

^{3/} Includes \$1,000 for five single-purpose structures; \$47,000 for recreational grounds and facilities and \$100 for municipal water facilities at structure No. 13; \$15,500 for recreational grounds and facilities and \$200 for the embankment at structure No. 10.

January 1970

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Mill Creek Watershed, West Virginia

(Dollars) ^{1/}

Item	: Estimated Average Annual Damage :			: Damage Reduc- : tion Benefit
	: Without	:	: With Project	
: Project	:	:	:	:
Floodwater				
Crop and Pasture	3,900	1,000	2,900	
Other Agriculture	13,700	2,000	11,700	
Commercial	25,700	400	25,300	
Residential	97,900	2,700	95,200	
Road and Bridge	4,900	400	4,500	
Utilities	700	0	700	
Municipal	8,500	0	8,500	
<hr/>				
Subtotal	155,300	6,500	148,800	
<hr/>				
Indirect	20,400	700	19,700	
<hr/>				
TOTAL	175,700	7,200	168,500	
<hr/>				

1/ Price base: Adjusted Normalized.

January 1970

TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Mill Creek Watershed, West Virginia

(Dollars) 1/

Evaluation Unit	AVERAGE ANNUAL BENEFITS							: Total	: Avg. Annual ^{3/}	: Benefit Cost Ratio
	: Damage Reduction	: Urban	: Recreation	: Recreation	: Recreation	: Municipal and Industrial	: Secondary			
All Structural Measures	162,700	91,300	523,800	62,300	17,200	78,100	935,400	307,100	3.0:1	
Project Administration	--	--	--	--	--	--	--	23,200	--	
GRAND TOTAL	162,700 <u>2/</u>	91,300	523,800	62,300	17,200	78,100	935,400	330,300	2.8:1	

1/ Price base adjusted normalized for benefits; 1968 for costs.

2/ In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of \$5,800 annually.

3/ From Table 4.

January 1970

INVESTIGATIONS AND ANALYSIS

Land Use and Treatment

Present land use in the watershed was determined from measurement of aerial photographs. These records were modified by Soil Conservation Service work unit personnel.

Future land use is based on good land management considering land capability, intentions of local landowners, and obvious trends in land use as recognized by agricultural workers concerned with the watershed area.

Work unit and area office personnel of the Soil Conservation Service cooperated in development of land treatment measures to be installed. These measures were taken from the total needs that will result from anticipated land use changes. Consideration was given to the usual good cooperation of landowners in the watershed and also to length of installation period in arriving at the quantity of each type of practice included.

Economic Investigations

Standard damage data supported by interviews were used to appraise the commercial, utilities, and urban residential damages. Individual damage schedules for representative residences, businesses, other agricultural, and transportation facilities were completed by personal interview. These schedules contained information as to physical losses experienced in previous floods with related high water elevation. The flood of March 1967 was considered as the base or key flood.

Floodwater damages were computed using the damage-frequency relationship method as described in Chapter 3 of the Economics Guide, Soil Conservation Service, March 1964. Damage summaries were tabulated by stages and adjusted to normalized prices using indexes of "Interim Price Standards for Planning and Evaluating Water and Land Resources," Water Resources Council, April 1966. The Economics 2 data processing program for the IBM 1130 computer was used to process average annual damages, including damage to crop and pasture.

The benefit to municipal and industrial water supply was based on the cheapest alternative which would provide an equivalent water supply both in quality and quantity. Consulting engineers representing the sponsors submitted a report showing that the cheapest alternate would cost \$350,000 and that the annual equivalent benefit would not be less than \$17,200.

Redevelopment benefits in accordance with the Economics Guide were counted. This amounts to 30 percent of construction cost and 50 percent of operation and maintenance cost limited to 20 years. Both are on an annual basis. Secondary benefits were estimated at 10 percent

of direct floodwater damage reduction benefits, urban changed land use, recreation, and municipal water benefits as suggested in Chapter 11 of the Economics Guide.

Transportation damages were evaluated on the basis of summarized interviews with county officials and flood plain occupants. Damages sustained were expressed in dollars and related to stage and frequency of occurrence at a given velocity to determine average annual damages.

Changed land use from agricultural to non-agricultural or urban use was based on estimates provided by the local sponsoring organization enhancement committee. Their preliminary estimate that 375 acres would be made flood free for fifteen hundred new building lots was adjusted at a later date to more accurately correspond to hydrologic conditions and allow for areas that were already partly developed. It was concluded that changed land use benefits of \$91,300 annually would be applicable to 200 acres out of 336 acres protected from the 100-year flood. This was considered to be synonymous with expected future growth.

Installation cost of structural measures was amortized at 4-7/8 percent interest for the life of the project. Cost of multiple-purpose structure No. 10 and No. 13 was allocated to purpose by the "Use-of-Facilities" method of cost allocations. All installation costs are based on 1968 prices. Operation and maintenance costs were based on long-term price levels.

Geologic Investigations

Preliminary geologic investigations were made of all proposed structure sites. These investigations were carried out using outcrops, road cuts, soil auger, and portable refraction seismograph. Available geologic maps, soil maps, and literature were studied. Local persons such as well drillers were interviewed. Geologic maps and profiles of the sites were prepared using the information obtained. No subsurface investigations have been made. A detailed geologic investigation will be made prior to final design.

All sites will be located in sedimentary rocks of the Lower Dunkard (Washington) Group of Permian age. In this area the Dunkard generally consists of cyclic deposits of sandstone, siltstone, shale, thin fresh-water-limestone, and thin, impure coal. The sandstones are locally massive but often consist of several lenses separated by shaly zones. The sandstones affect the topography by forming cliffs or benches and produce the "benchy" topography typical of this area. Greenish-gray to grayish-red shale is the dominant rock type. These shales or claystones are often purplish-red, usually lack well defined bedding planes and are generally non-fossiliferous. These strata exhibit much lateral variability.

There are no major geologic structures in the watershed. There is a gentle regional dip of about 25 feet per mile northwest toward the axis of the Parkersburg syncline which crosses Mill Creek 3 miles west of Ripley.

Sites No. 4, 5, 6, 8, and 9 are located in similar topography and near the same stratigraphic position. Generally these sites are located in narrow valleys with steep abutments and relatively flat flood plains. Foundations are stable with from 5 to 15 feet of alluvial clay or clayey silt over sandstone and shale bedrock. Sandstone layers found in emergency spillways are expected to be rock excavation. Borrow material will consist of alluvial clay and silt from the flood plain, silty and gravelly clays from residual and colluvial soils on hillsides and benches, and shale from emergency spillway cuts. Some flood plain soils in this area exhibit seasonably high water tables and some areas are somewhat poorly drained. Potential borrow areas have been located to take advantage of the well drained areas.

Multiple-purpose site No. 13 is located at the base of the Dunkard Group. The Waynesburg sandstone outcrops in the creek and lower abutments. Water-holding potential of the site is good. The engineering consulting firm of Kelley, Gidley, Staub, and Blair recommended the site as the most practical source of water supply for the city of Ripley. In their report they state that "there would be no reason to assume that conditions would be present that would affect the ability of the site to hold water."

Multiple-purpose site No. 10 is located in a wide flood plain on Elk Fork near its confluence with Little Mill Creek. Geologic conditions are similar to the other sites but physically the site is somewhat different. Seismic data and data on water wells indicate the alluvium to be approximately 25 feet deep at this site. The top 10-12 feet is exposed in the streambank and consists of silty clay and clayey silt. Bedrock consists of nearly horizontal sandstone and shale. Information gathered to date indicates that the water-holding potential is good.

There are several gas wells scattered across the watershed; however, only one existing well will be affected by the proposed structures. At site No. 10 there is a gas well in the recreation pool area. Owners of the well were contacted and a cost for buying and plugging it was included in the land rights cost.

Available geologic literature indicated that there are no economically minable coals present either above or below drainage.

Sediment storage requirements for the structures were computed for a 100-year design life. Soil survey maps and field inspection were used to determine the soil type, slope, erosion, and cover conditions. The amount of sheet erosion was calculated using Musgraves "Probable Soil Loss Formula." Sediment delivery rates and trap efficiency were determined using procedures contained in SCS Technical Release No. 12 for each site.

Hydrologic and Hydraulic Investigations

Mill Creek Watershed (123,250 acres or 192 square miles) has a dendritic type drainage pattern with a length-width ratio of approximately 1.0:1.0.

There is no stream gage in this watershed. Rainfall data was obtained from U.S. Weather Bureau Technical Paper No. 40 (TP-40) and the Ravenswood Dam 22, Racine Dam 23, Liverpool, Ripley, Spencer, Tribble and Winfield Locks, U.S. Weather Bureau gages. Hourly distribution of historical events was obtained from the Liverpool and Tribble Weather Bureau gages. An isohyetal map of the key storm of March 6, 1967, was produced using all of the gages previously mentioned.

Soils and cover data were developed from soils maps and land use data with assistance from the district conservationist for Jackson County. Changes in land use data were updated by field observations.

Several combinations of structures were considered during the project formulation. Structures were eliminated on the basis of cost versus benefits provided. The combination of seven structures was determined to most nearly meet project objectives.

Hydrologic soil-cover complexes were tabulated as outlined in the SCS National Engineering Handbook, Section 4 (NEH-4). Curve numbers for open land were developed by the SCS. The U.S. Forest Service computed curve numbers for forest land.

Runoff was determined as outlined in the SCS National Engineering Handbook, Section 4 (NEH-4), with the appropriate values of rainfall and runoff curve number.

Valley sections were located to reflect flood stage at points of damage, restrictions, grade control, and typical sections for area inundation calculations. Channel and valley sections were obtained by field survey. High watermark elevations were secured when available and referenced to the respective station.

Time of concentration of subareas and sites was based on channel hydraulics. Channel sections were surveyed and bank-full velocities were computed. Overland flow was computed using SCS Memo WS-Hydrol EWP-1 (UD).

The watershed was divided into subareas to reflect economic and hydrologic characteristics, soils, and cover. Routings were performed using the IBM electronic computer and procedures outlined in SCS Technical Release No. 20. The 100-, 25-, 5-, and 2-year, 1-day storms were routed to establish discharge-frequency relationships. The key flood (March 6, 1967) was also routed, and routed peaks were used to verify discharge-frequency relationships. The hydrologic effect of changed land use and treatment was determined by using the simplified procedure outlined in SCS Memo WS-Hydrol, EWP-2 (UD).

Structure No. 10 is a single-stage multiple-purpose recreation and flood prevention structure. Structure No. 13 is single stage multiple-purpose recreation, municipal water, and flood prevention structure. Structures No. 4, 5, 6, 8, and 9 are single-stage single-purpose flood prevention structures. All storage figures are in excess of NEH-4, Chapter 21, and Washington Engineering Memo No. 27 requirements since the antecedent moisture condition $2\frac{1}{2}$ runoff curve number was used with this criteria to determine storage requirements.

The size of pipe used in the drop inlet pipe spillway was based on the optimum combination of release rate, channel capacity, and damage situation below each site.

Engineering Investigations

Investigation of structural measures for the plan included analysis of 20 single-purpose floodwater retarding structures, 1 multiple-purpose structure incorporating both floodwater and recreation storage, and 1 multiple-purpose structure incorporating three purposes--flood prevention, recreation, and municipal water supply. After studying various alternate combinations of these structures and their effect on watershed problems, it was determined that 5 single-purpose floodwater retarding structures and 2 multiple-purpose structures would be the most economical system to meet local objectives. Locations of these measures are shown on the project maps. Other sites investigated contributed little to protection of the damage area while involving high construction and relocation costs. Tables 2, 2A, and 2B give costs of each measure and table 3 lists other pertinent data including dimensions and capacities.

For purposes of developing preliminary designs, topographic maps were drawn. For sites No. 4, 5, 6, 8, and 9 these maps are to a scale of 1" = 100' horizontally with 4-foot contour intervals. The map for site No. 10 was drawn to a scale of 1" = 200' horizontally with 5-foot contour intervals, and for site No. 13 the scale is 1" = 400' horizontally with 10-foot contour intervals. Horizontal control was established by transit-chained traverse in the construction area and a transit stadia traverse in the retarding pool area. Vertical control was based on sea level datum using United States Coast and Geodetic bench marks. Stage-storage relationships were developed by planimetering the area bounded by contours above the dam. Stage-storage volumes were then computed using the average-end-area method.

For the five single-purpose structures the riser crest was set at the elevation of the sediment pool created by storing the 50-year submerged sediment accumulation. For site No. 10 (flood prevention and recreation) the riser crest was set at the elevation of the recreation pool created by storing the 100-year submerged sediment accumulation and recreation storage. The riser crest for site No. 13 was set by storing the 100-year submerged sediment accumulation plus recreation and municipal water-supply storage. A storage allowance for evaporation and seepage was also made for the two multiple-purpose structures. Hydraulic computations

were made assuming that the structures and reservoirs had reached the condition anticipated at the end of the 100-year evaluation period in accordance with Engineering Memorandum WV-8.

It is anticipated that the reinforced concrete principal spillway conduit will rest on a yielding foundation on sites 4, 5, and 10. Preliminary geologic investigations indicated that bedrock on these sites was too deep for placement of the principal spillway and construction of an adequate outlet channel. Foundation materials upon which the principal spillway will be placed are generally composed of a low plasticity clay (CL). On sites 6, 8, 9, and 13 preliminary geologic investigations indicated that principal spillways could be placed on bedrock. Foundation materials for these sites will probably be red shales or sandstone. Discharge through the principal spillway was determined using procedures in National Engineering Handbook (NEH)-5. Computations were made using the IBM 1130 computer program at the Technical Service Center, Upper Darby, Pennsylvania.

Due to the location of site No. 10 and its relation to the main Mill Creek flood plain, special consideration was given to the preliminary design of the principal spillway since it will be submerged by the evaluation storm. Principal spillway storage was computed by routing runoff from the 100-year, 10-day duration storm through the principal spillway assuming a tailwater elevation equal to the elevation of the evaluation storm profile, or elevation 626.7. This computation resulted in a net flood storage of 3.51 inches or 4,944 acre-feet when routed through twin 48-inch conduits. Time to empty computations were made by assuming a tailwater elevation created by an average release rate from the five structures upstream plus 5 csm quick return flow from the uncontrolled area. This resulted in a tailwater elevation of 614.00. Based upon this assumption it requires 9.2 days to empty 100 percent of the flood storage.

Height and capacity of the dam and reservoir were determined using current criteria in SCS Engineering Memorandum 27. All structures were given a high hazard classification (c). Net flood storage was developed by using runoff from NEH-4 for antecedent moisture condition 2 $\frac{1}{2}$. Design storage was added to the structures where a more economical structure proportioning would result. Discharge through emergency spillway was computed by the method outlined in SCS Technical Release (TR) No. 35. Allowable velocities in the emergency spillways were based on the type of material present. Where velocities were considered to be erosive, additional flood storage was included in the structure, which resulted in decreased emergency spillway velocities and a more adequate emergency spillway design. Final sizing of the structures was accomplished by comparing costs of emergency spillway excavation, earth fill embankment, and land rights.

Construction materials are readily available for construction of dams within the site area itself with the exception of material to be used for filter and rock riprap. Most of the material for earth embankments will come from emergency spillway excavation (red shales) and sediment and flood pool areas (CL). Rock riprap and filter material

will come from outside the site area. The dams were planned with 3:1 upstream slopes and $2\frac{1}{2}$:1 downstream slopes. Foundation work consists of stripping one foot under the dam plus excavation of a cutoff trench to underlying bedrock.

Further geologic investigations will be necessary during final design to better establish characteristics of construction materials and foundation conditions of the dams. Final designs will be completed during the operation phase of this project.

Site No. 13 was planned as a multiple-purpose structure to include recreation and municipal water storage in addition to flood storage. Recreation facilities, size of lake, and access to the development was planned by the West Virginia Department of Natural Resources. Elevation of the recreation pool was established by existing topography best suited for development. Unusual features of this development include a recreation access road across the top of the dam to provide access to boat docks and parking lots immediately above the dam. Kelley, Gidley, Staub, and Blair, Consulting Engineers, planned the municipal water features of this dam. Information concerning the amount of storage (1400 acre-feet), quality of water and ability of the site to hold water was presented to the Service for use in this plan. A special outlet gate will be required to release municipal water into Tug Fork.

For more detailed information concerning the recreation and municipal water investigations, see the material under those specific headings.

Forest Land

Information on the hydrologic condition of the forest land in the watershed and the reasons for the present hydrologic condition were obtained in a series of systematically selected field plots. This information formed the basis for developing the precipitation-runoff curve numbers and land treatment needs for the forest land. The data obtained included measurements of the litter and humus layers, determination of soil type and other hydrologic factors. It also included recording the presence or absence of disturbance factors such as fire, grazing, cutting, logging, and the abnormal infestation of insects or disease which might adversely affect the hydrologic condition or increase the fire hazard.

Adequate forest fire protection is provided by the West Virginia Department of Natural Resources, Forestry Division, cooperating with the U.S. Forest Service through the Clarke-McNary Cooperative Fire Control Program. During the past five years 21 fires have been reported. The 405 acres burned resulted in an average annual burn of 0.11 percent. The fire-loss index goal for the watershed is 0.2 percent. No appreciable increase is anticipated in fire occurrence or area burned as a result of construction activities, tree planting, or increased recreational use. Adequacy of protection is under continuous review by the Forestry Division.

Fish and Wildlife

Field investigations of the fish and wildlife resources of the watershed were made by the Soil Conservation Service, U S. Fish and Wildlife Service, and the West Virginia Department of Natural Resources. Analyses were made regarding the effects of the proposed project measures on these resources.

These investigations indicated the water quality of the Mill Creek drainage system was sufficient for good fish production. Tests of water taken at various locations show a pH of approximately 7.0. Iron content was about 0.1 part per million with a hardness of 7.0 grains per gallon. A fish and wildlife survey was conducted of the area. Game fish found in this drainage system included muskellunge and spotted bass. Other fish included crappies, catfish, several varieties of sunfish and suckers. The standing fish crop was estimated at 221 pounds of fish per acre.

Principal wildlife species recorded included cottontail rabbits, botwhite quail, ruffed grouse, squirrels, and some whitetail deer. The deer herd appears small at present; however, local residents report that it is increasing in size. Wildlife habitat conditions in the watershed favor small game production. A few waterfowl also occur during migration periods.

Analysis of the works of improvements to be installed and their effect on the fish and wildlife resources of the area indicate that the improvements will have no significant adverse effects while increasing the opportunity for improving these resources, especially in the vicinity of the proposed recreation lakes. Construction of seven dams in the headwater region will benefit the downstream fishery by lessening siltation and reducing high flow velocities. A warm-water fishery will be established at both sites 10 and 13. Boat launching ramps and water level control gates have been included in design of the dams to maximize fishery benefits. To increase the fishery potential of the stream below the structures, renovation of the fish population will also be stressed. This will be accomplished by destroying most of the non-game or "rough fish" and restocking with more desirable species.

Installation of land treatment measures will result in improvement of wildlife resources. Food and cover conditions will be improved by controlling grazing and reforestation. Special care will be given to select plants having high value for wildlife foods and cover.

The fish and wildlife aspects of this plan will be coordinated with the West Virginia Department of Natural Resources during project installation.

Recreation

The potential of site No. 13 for recreation development was investigated jointly by the Service and planners from the DNR. Locations of potential recreation areas were made by field inspection and study of

topographic maps. The Service provided detailed topographic maps of selected areas to the DNR. Detailed plans and cost estimates were prepared by the DNR and concurred in by the Service.

Site No. 10 was studied by the Service and the Jackson County Court. Plans for day-use recreation areas were developed in accordance with the type of development desired by the Court. The facilities are planned to utilize favorable aspects of the topography and will complement instead of compete with site No. 13.

The West Virginia Department of Health participated in the development of plans for water supply and sanitary facilities for the recreational complexes. The use of wells as the water supply for the recreational developments was investigated by the Service and DNR. Data was obtained from the USGS and local residents concerning existing wells as to quantity and quality. All information obtained indicated that wells would provide a safe and adequate supply of drinking water.

The quality of water for use in the recreation lakes on Tug and Elk Forks was investigated jointly by the DNR and the Service. Their investigations indicated that the water was of adequate quality for the type of recreation developments planned, and there is no apparent reason for any great change in these conditions.

Municipal Water Investigation

Information on the municipal water supply features proposed in this plan was developed by an engineering consulting firm, Kelley, Gidley, Staub, and Blair of Charleston, West Virginia. This firm has had a long and very outstanding record of public service in West Virginia and has planned and designed water supply and sewage disposal systems for several communities throughout the state.

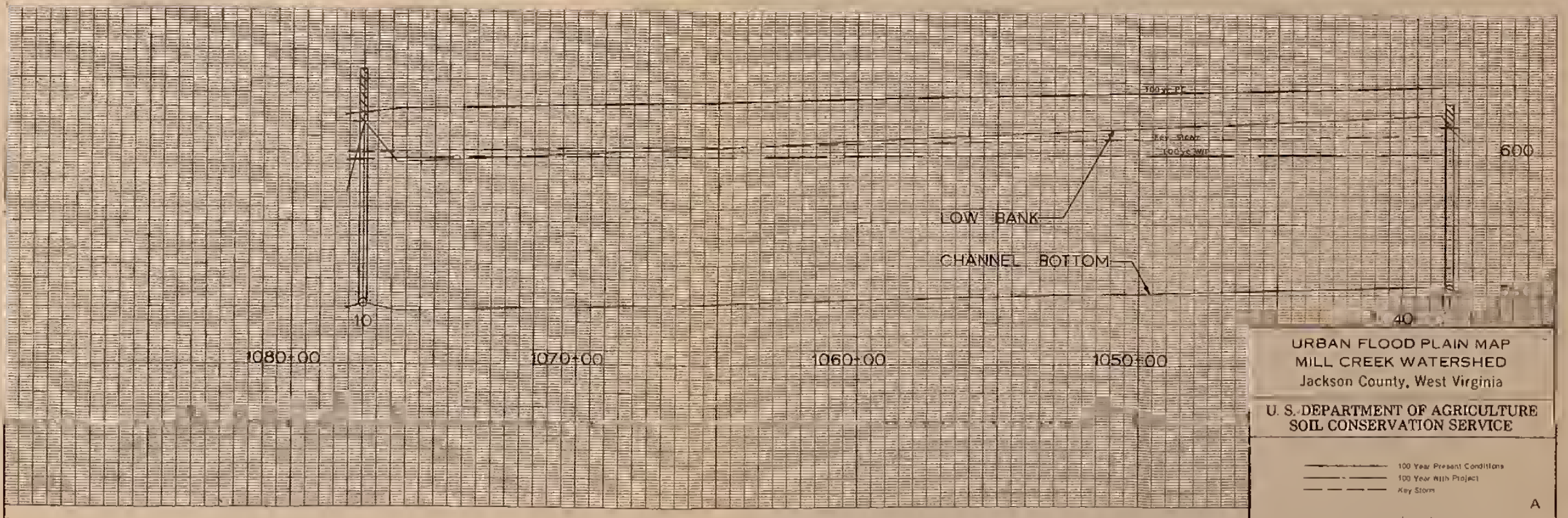
Past population trends of the city of Ripley were tabulated and analyzed and future population projections made based upon future anticipated trends. This study projected a population growth of about 50 percent or from a population of 3,500 people to 7,000 people. Based upon this estimate, the city of Ripley would be required to supply water to an additional 1,800 water customers. After considering present and future water supply use rates, it was determined that the estimated water supply requirement for both municipal and industrial use would be about 210,000,000 gallons.

Evaporation from the lake surface and the surface of the stream was estimated to be 550 acre-feet. Seepage losses under the dam and channel losses throughout the 9.5 miles of channel from the dam to the treatment plant is estimated at 200 acre-feet. In order to provide the required municipal supply at Ripley, the engineering consultants recommend storing 1,400 acre-feet of additional water.

As a source of supply, three structure sites were studied. They were site No. 5 located on Big Run, site No. 10 on Elk Fork, and site No. 13 on Tug Fork. The potential of these sites was evaluated by considering availability of water to meet the needed water requirements, proximity of the sites to Ripley, water quality, and cost of water storage. Based upon this study, site No. 13 was selected for water supply storage.

The city of Ripley presently has a modern water treatment plant that provides water supply for its residents. Water is taken directly from Mill Creek and treated before distribution. Treatment consists of coagulation, sedimentation, filtration, and sterilization. Structure No. 13 will be designed to release controlled flows of water into Mill Creek which will be drawn from the stream and treated at the present plant. Water samples, taken in the vicinity of structure No. 13 by the West Virginia State Health Department indicated that water quality would be acceptable for municipal and industrial use with the present level of treatment.

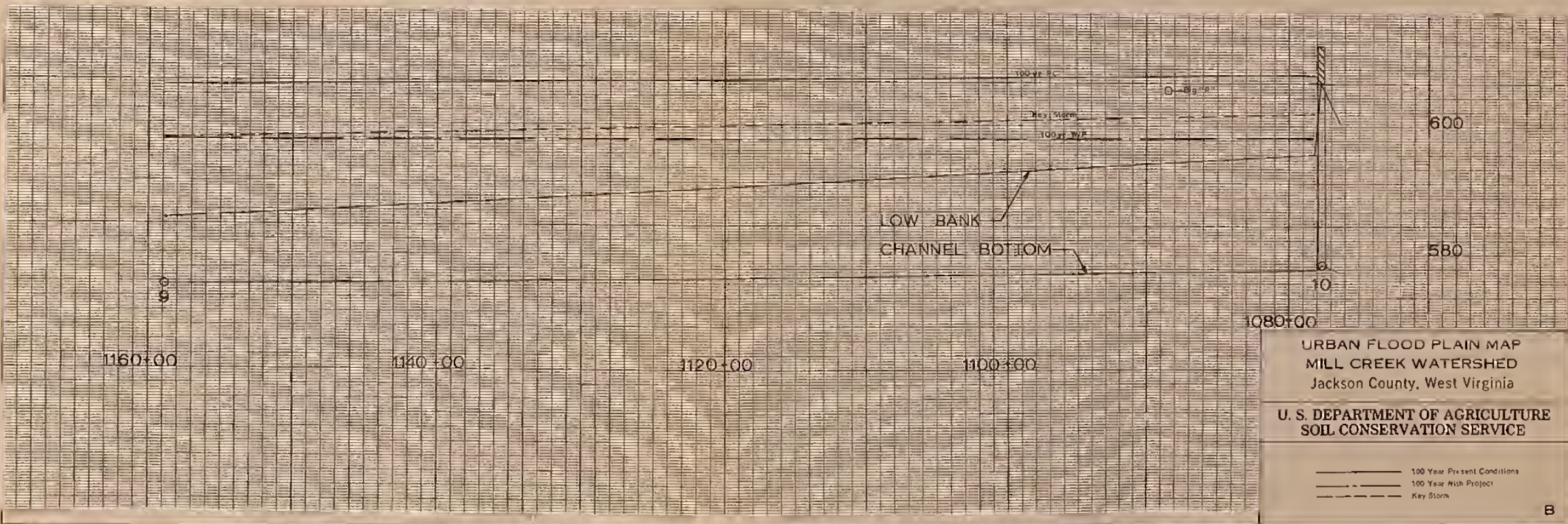
A study of geologic maps along with an on-site investigation indicated that geologic features would not adversely affect the ability of the site to hold water. This study indicated that soft shales and sandy-silt loams underlaid by hard sandstones exhibit very good water-holding characteristics. No subsurface exploration was made during this investigation; however, after project approval, a detailed geologic study to include a drilling program and subsurface investigation will be conducted to verify the results of this analysis.

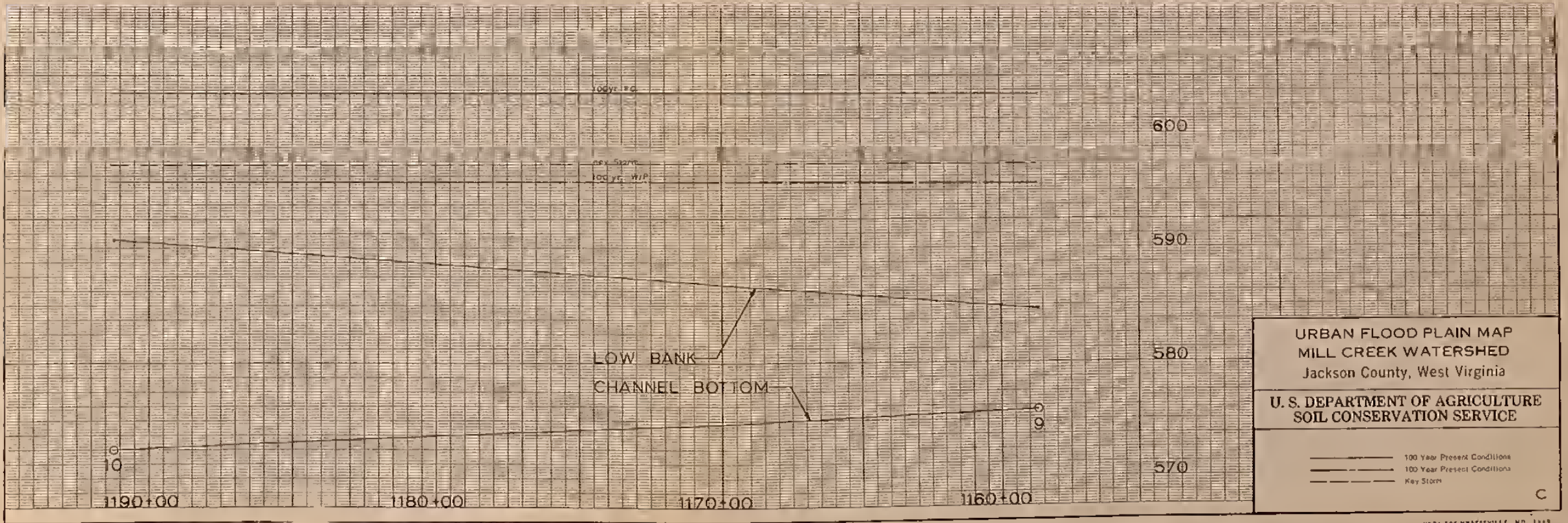


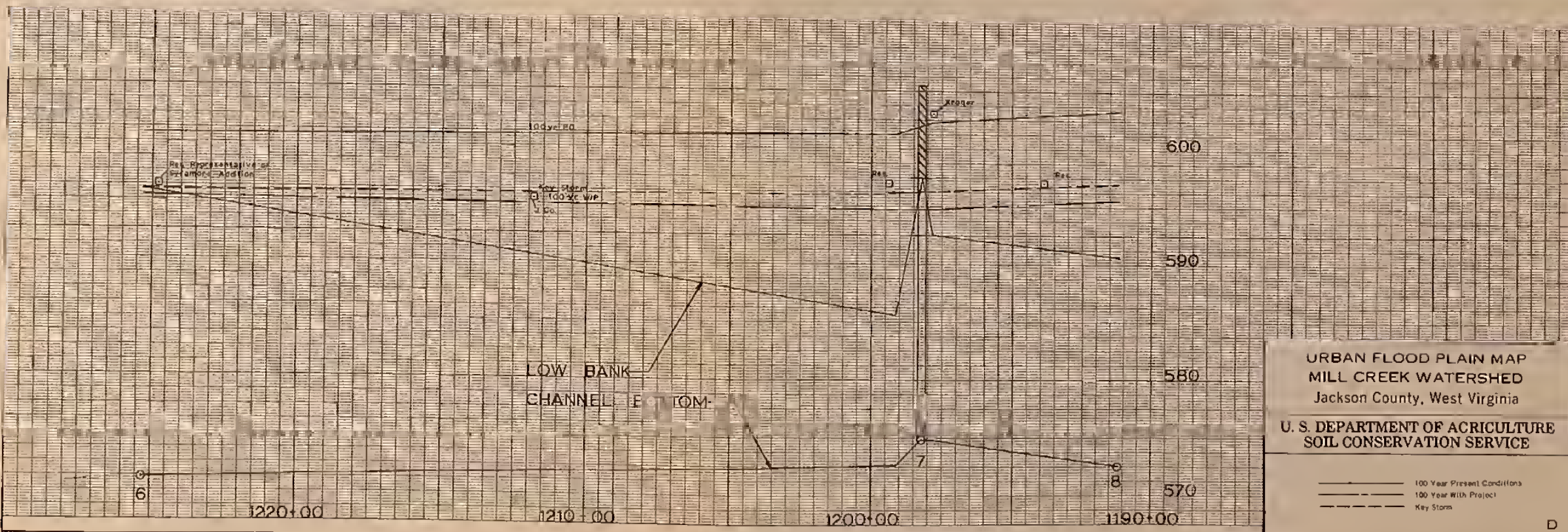
URBAN FLOOD PLAIN MAP
 MILL CREEK WATERSHED
 Jackson County, West Virginia
 U. S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE

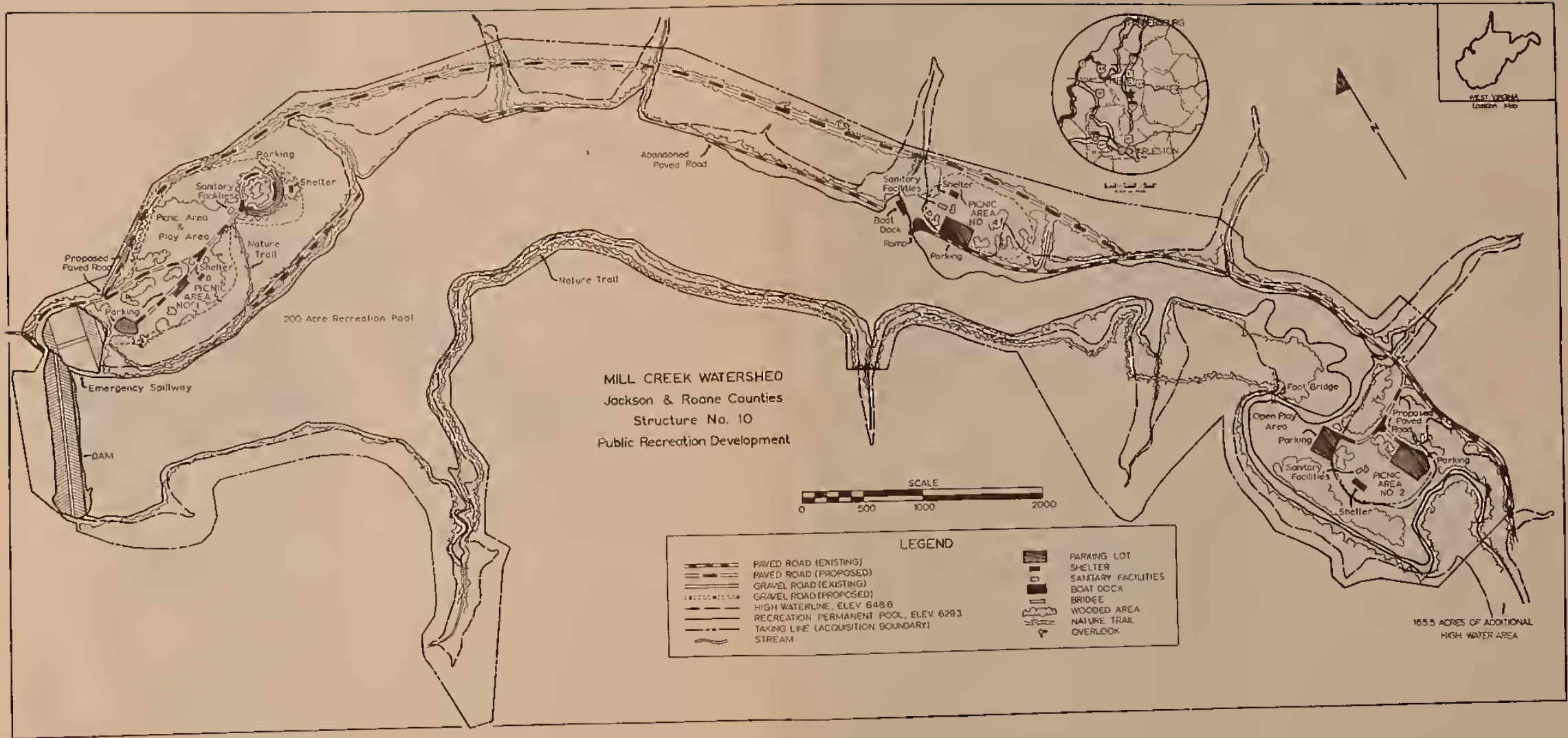
- 100 Year Present Conditions
- 100 Year With Project
- Key Storm

A

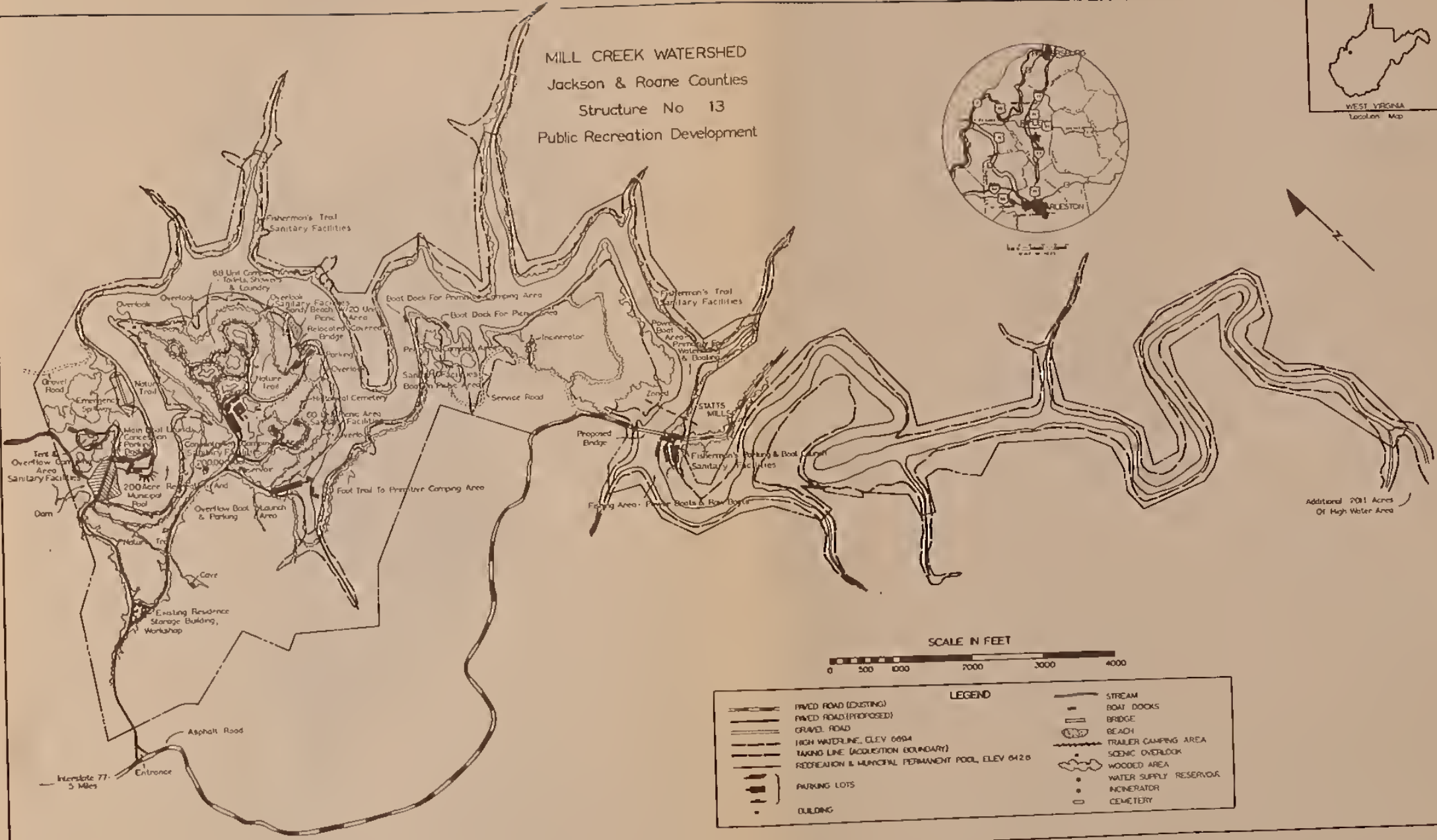




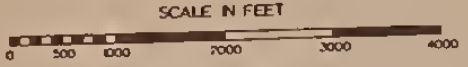




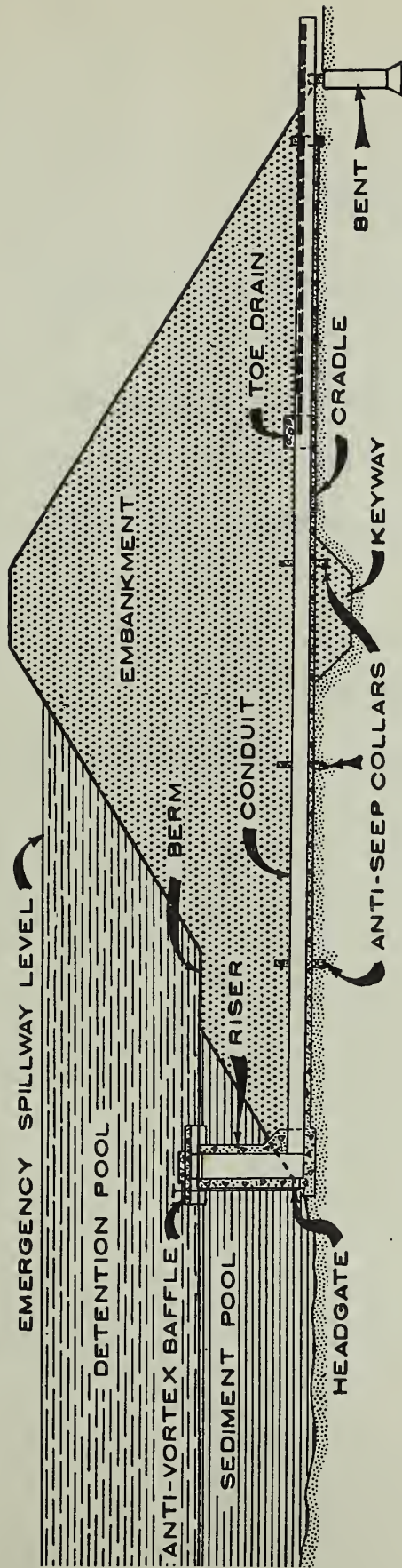
MILL CREEK WATERSHED
 Jackson & Roane Counties
 Structure No 13
 Public Recreation Development



Additional 200 Acres
 Of High Water Area



LEGEND			
	PAVED ROAD (EXISTING)		STREAM
	PAVED ROAD (PROPOSED)		BOAT DOCKS
	GRAVEL ROAD		BRIDGE
	HIGH WATERLINE, ELEV 6694		BEACH
	TAKING LINE (ACQUISITION BOUNDARY)		TRAILER CAMPING AREA
	RECREATION & MUNICIPAL PERMANENT POOL, ELEV 642.6		SCENIC OVERLOOK
	PARKING LOTS		WOODED AREA
	BUILDING		WATER SUPPLY RESERVOIR
			INCINERATOR
			CEMETERY



SECTION OF A TYPICAL
FLOODWATER RETARDING STRUCTURE

ADDENDUM

Mill Creek Watershed, West Virginia

This addendum shows the project costs, benefits, and benefit-cost ratio based on a 5-1/8 percent interest rate. Annual project costs, benefits, and benefit-cost ratio are as follows:

- | | |
|--------------------------------------|------------------|
| 1. Project costs are | <u>\$343,400</u> |
| 2. Project benefits are | <u>938,500</u> |
| 3. The project benefit-cost ratio is | <u>2.7 to 1</u> |





